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JUNE 26, 1947

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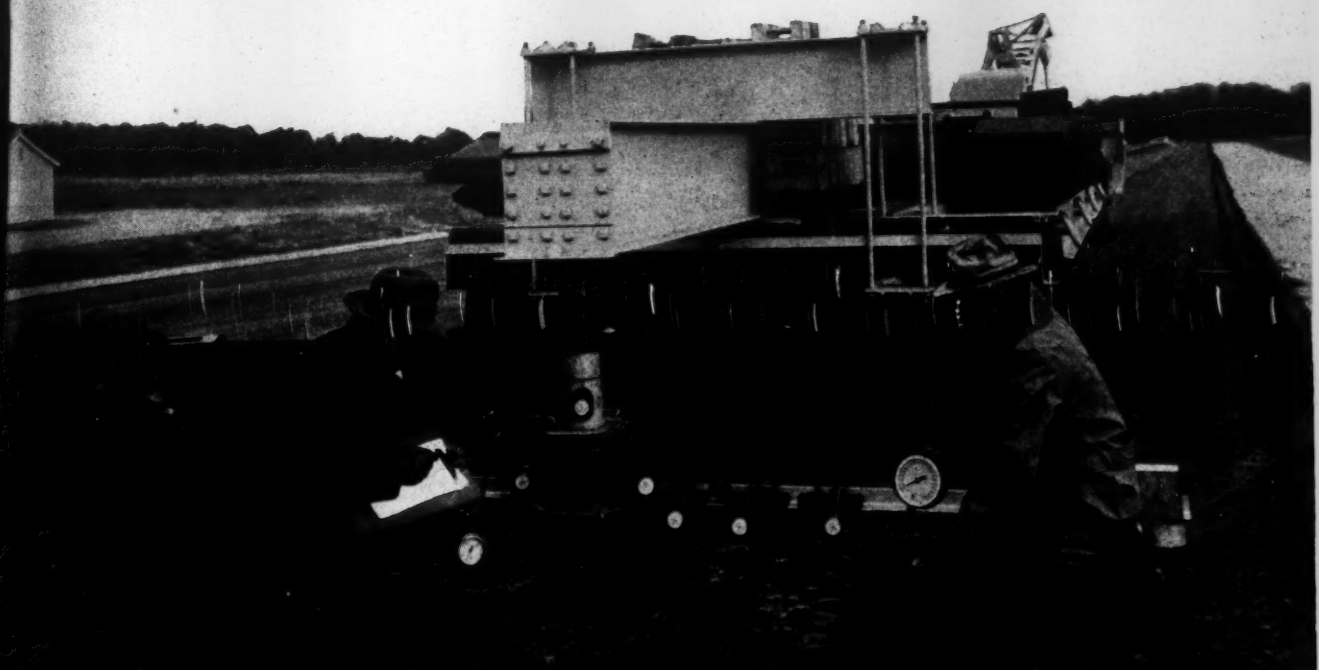

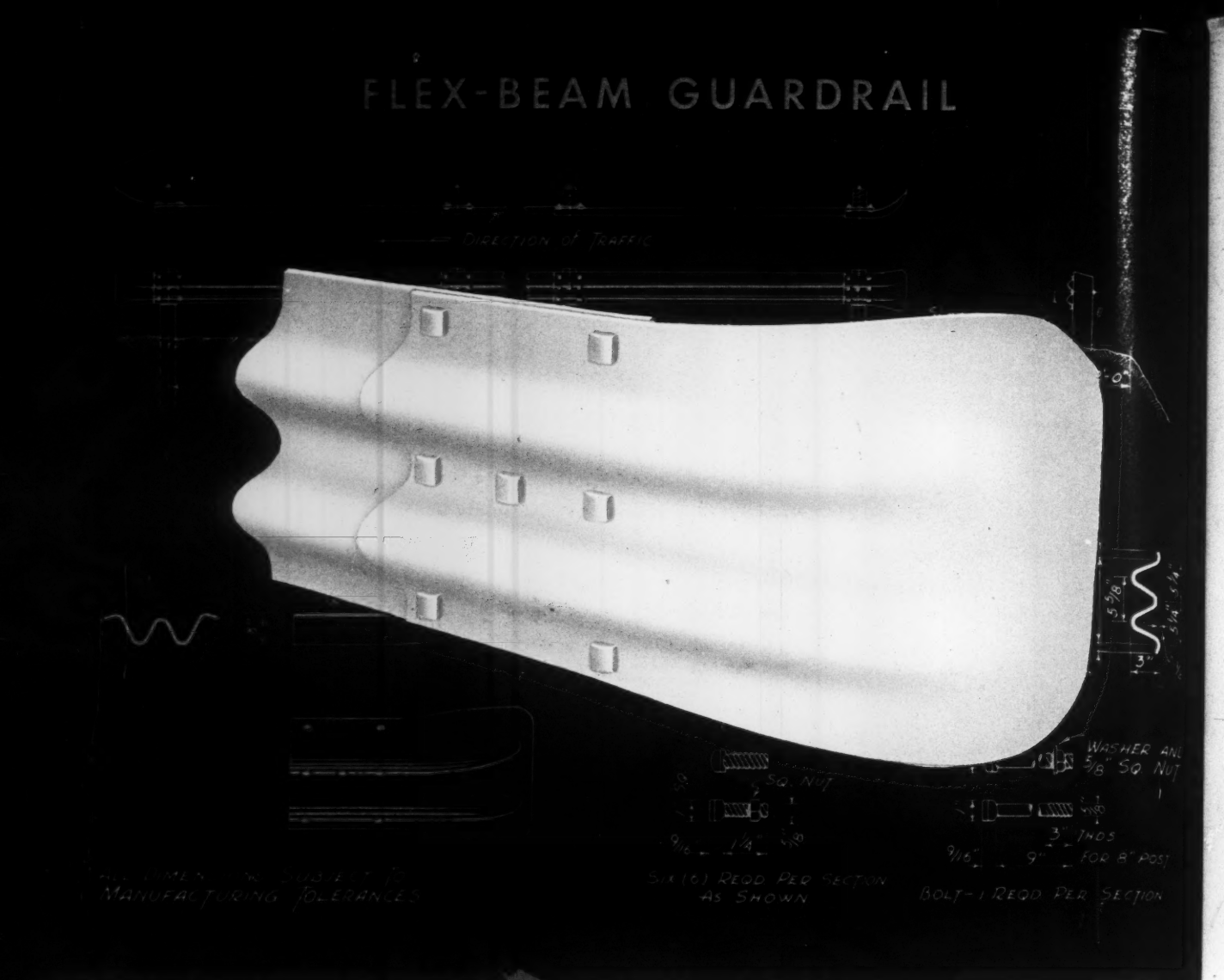

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Volume 138 • Number 26

ENGINEERING NEWS-RECORD

JUNE 26, 1947

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Number of Copies of this issue printed 43,504

ENGINEERING NEWS-RECORD
Published By
McGRAW-HILL PUBLISHING CO., INC.
Publication Office:
99-129 N. Broadway, Albany 1, N. Y.
Editorial and Executive Office:
330 W. 42nd St., New York 18, N. Y.

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330 West 42 St. New York 18, N. Y.

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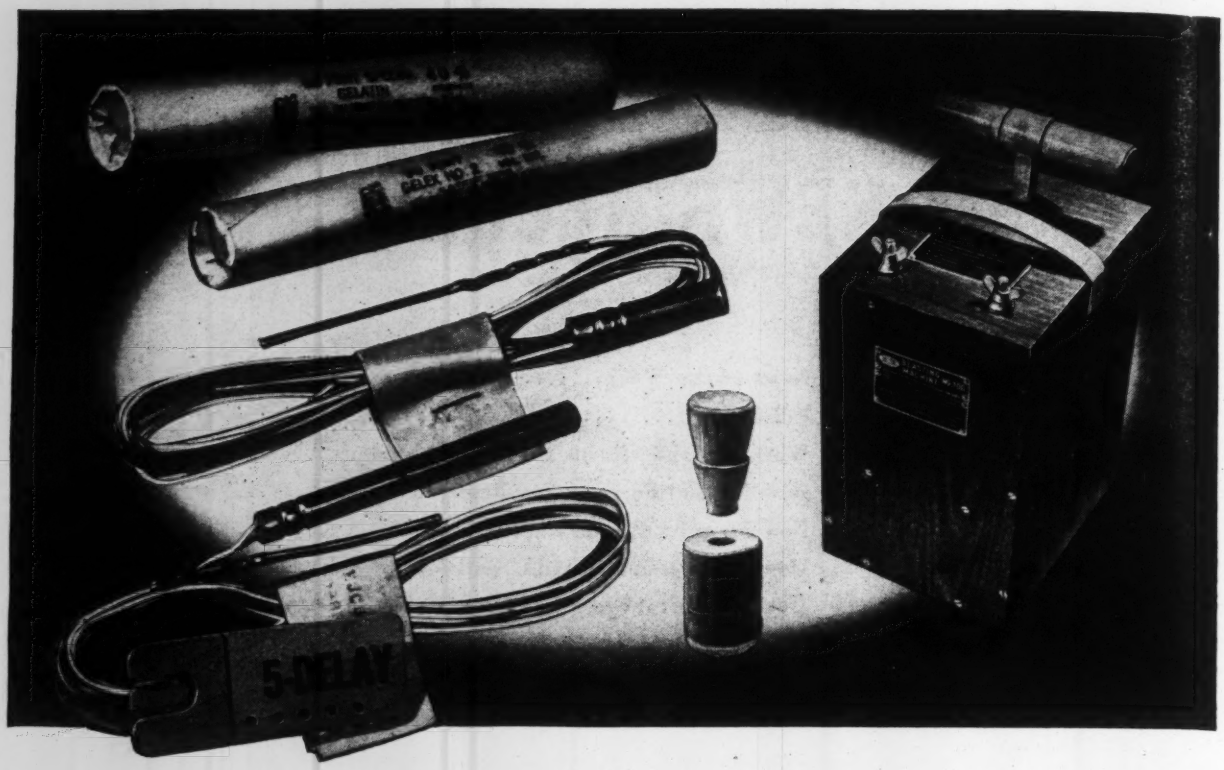

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Construction Trends

Earthwork, Irrigation and Drainage Contracts Third Highest on Record

Although total earthwork, irrigation and drainage contracts awarded during the first 25 weeks of 1947 were 27.6 percent below the corresponding period for 1946, they were still the third highest on record. The dollar volume of contracts totalled $134,500,000 during this period of 1947, as reported by *Engineering News-Record*, and was exceeded only in 1942 and 1946 when the 25-week contracts totalled $196,000,000 and $185,900,000, respectively. Earthwork and drainage contracts awarded in 1947 rose 700 percent above the 25 week low for the war years of $16,800,000 reached in 1945.

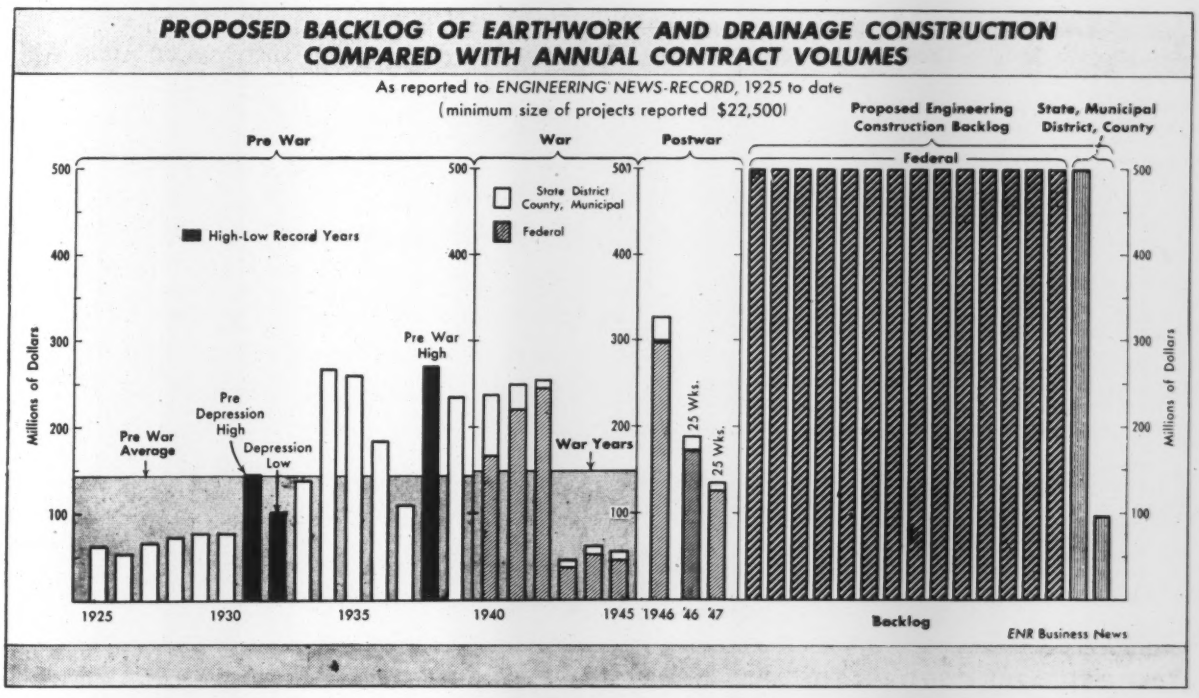
Of the total contract awards so far this year, 93.7 percent were for federal jobs. The remaining 6.3 percent were for state and municipal jobs. This distribution of contract awards was very similar to the relative proportions maintained in 1946. During the 25-week period of 1946, 93.9 percent of the total contract awards were federal and 6.1 percent were state and municipal.

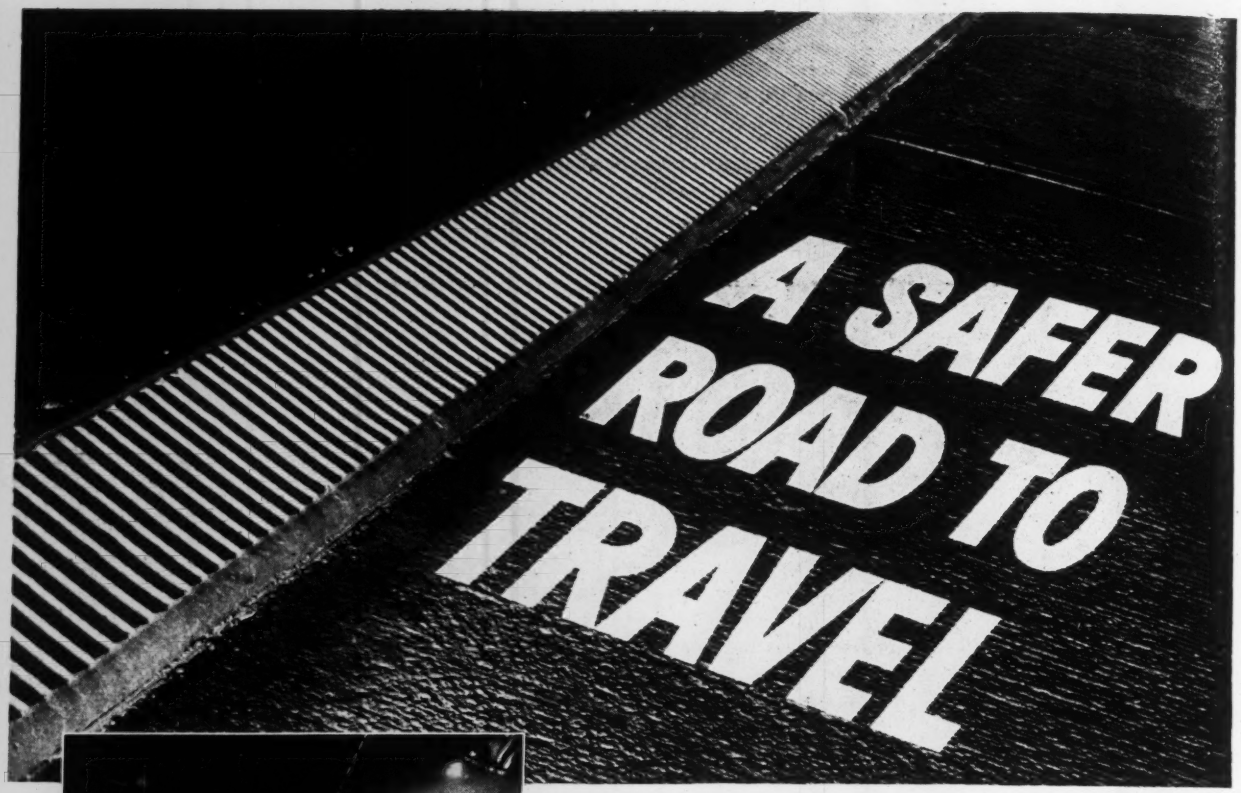
The actual dollar volume of federal contract awards for the first 25 weeks of 1947 amounted to $126,000,000 and of state and municipal awards to $8,500,000, declining 27.8 percent and 25.4 percent, respectively, from the 1946 totals. Federal contracts amounted to $174,500,000 in 1946 and state and municipal contracts to $11,400,000.

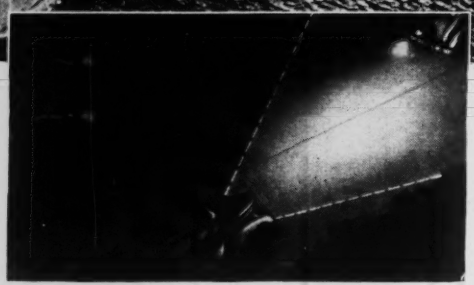
The year 1946 as a whole reached a new high record in earthwork and drainage contract awards of $327,600,000, a gain of 22.0 percent over the previous year's record of $268,500,000 reached in 1938. When compared with the recent war and all-time low of $47,600,000 in 1943, 1946 was nearly seven times that amount. Here again, federal contracts of $302,600,000 accounted for 92.4 percent of the 1946 total, while state and municipal contracts of $25,000,000 for only 7.6 percent.

The backlog of proposed work cumulative through May 1947 totalled $7,596,777,000 based on 1940, 1943, 1944, 1945, 1946, and 1947 costs and values. Of this amount, approximately $7,000,721,000, or 92.2 percent, is slated for federal jobs and $596,056,000, or 7.8 percent, for state and municipal jobs. At the record 1946 annual contract award rate, the backlog would still be equivalent to 23 years of work.

West of the Mississippi and the Far West account for nearly 77 percent of the proposed jobs, with West of the Mississippi totalling $3,101,323,000 and the Far West, $2,769,359,000. The individual states within these sections with the largest backlogs are California, Texas, Arizona, and Washington. California leads with a backlog total of $955,838,000. Although backlogs recorded for Texas, Arizona and Washington, all over $500,000,000, are below California's lead, they exceed the individual state totals for the rest of the country by at least $200,000,000.







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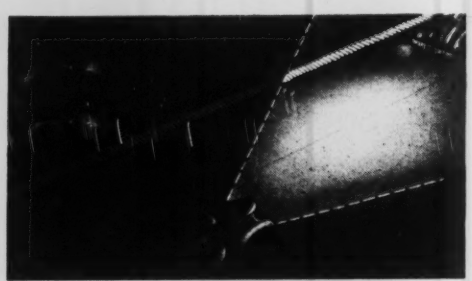

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News of the Week

ENGINEERING NEWS-RECORD • JUNE 26, 1947 • VOLUME 138 • NUMBER 26

Rent control bill removes most construction controls

President gets measure eliminating most of features of Patman Act, despite objections of housing expediter—Few controls to remain in effect

A rent control bill (H.R. 3202) that removes most major federal controls on construction, was completed by Congress and sent to the President last week.

The bill was passed despite the opinion of Housing Expediter Frank R. Creedon that the end of the restrictions will reduce the homebuilding program this year by over 200,000 homes.

As forwarded to the President, the measure eliminates most of the features of the Patman Emergency Housing Act passed by the last Congress (*ENR* May 16, 1946, vol. p. 766 May 30, vol. p. 833). This law permitted the National Housing Agency to obtain $400,000,000 from the Reconstruction Finance Corporation for use as subsidies and for guaranteed market contracts; the Federal Housing Administration's power to insure home loans was increased by $1 billion, and it provided $15,000,000 for construction of forest access roads.

The Patman Act also included continuance of priority control on the distribution of construction materials, established preference for veterans in the purchase and rental of new housing, placed ceiling prices on the sale of new homes, and gave the housing expediter the power to order the Office of Price Administration to change the ceiling price on building materials.

$50 million limit removed

Most significant effect of the rent control bill on the construction industry is relaxation of the control that has permitted limiting approvals of non-housing construction to a total of $50,000,000 weekly. This control was made effective by a permit system that excluded some types of construction, but placed strict control on other work. It prevented the starting of nearly $2 billions of non-housing work last year.

In the bill that went to the President last week a little of this control remains, but its effectiveness is believed to be small. The remaining control is outlined as follows:

"Whenever the Housing Expediter determines that there is a shortage, or that there is likely to be a shortage, of building materials, he may by regulation or order require . . . . a permit as a condition of constructing any building or facilities to be used for amusement or recreational purposes, other than a building or facilities constructed for use in connection with a state or county fair or an agricultural, livestock, or industrial exposition or exhibition."

Of the $1.9 billions of non-housing-construction that was not approved last year, less than $200,000 represented amusement and recreational construction, according to government figures.

Some of program remains

A few parts of the program authorized by the Patman Act remain effective. Although the House had favored elimination of the Office of the Housing Expediter on June 30 of this year, this office continues until Feb. 29, 1948. Also continued in force are allocations previously granted under the Patman law, as well as the price limitations on housing construction begun with priority aid. The guaranteed market work for prefabricated houses (*ENR* June 19, 1947, vol. p. 981) also remains effective, and homes built for sale must be reserved for at

(*Continued on page* 55)

Army plans $40 million medical center

A group of structures planned to make one of the greatest medical research centers in the world will be built at Forest Glen, Md., by the Corps of Engineers for the Office of the Surgeon General, the War Department announced this week. Initial cost is estimated at about $40,000,000. Construction will be supervised by the district engineer, Washington, D. C. district.

In keeping with technological advances in all fields, based on experiences in the late war, the center will be equipped to anticipate and meet the medical problems of the future as well as to cope with those of the present. Officially designated as the "Army Medical Research and Graduate Teaching Center," the project will consist of a 1,000-bed general medical and surgical hospital, capable of expansion to 1,500 beds. It will also include an Army Institute of Pathology building, an Army medical museum and center administration building, a group of buildings for a central laboratory, and facilities for the Army Institute of Medicine and Surgery. A working library, animal farm, staff quarters and other buildings are also planned.

Located on the edge of Washington, the center will have the advantage of close proximity to the Walter Reed Medical Center, the naval hospital, the medical schools of the District of Columbia and the $20,000,000 medical center authorized for the District by Congress (*ENR* Aug. 15, 1946, vol. p. 204).

Plans for the 1,000-bed hospital building, as announced by army engineers, provide that 200 beds shall be specifically designated as research beds and that these be so located as to be physicially accessible to research activities of the various institutes central laboratories. However, they will remain an integral part of the hospital for service and patient care. In the proposed future expansion, a proportionate number of beds will be reserved for research and these will be located in the same area as the original 200, with the same accessibility to other buildings. Any expansion would be horizontal, rather than vertical.

The estimated total floor space for the initial building is 650,000 sq. ft.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction — Ground has been broken for the new Pre-mix plant of Pillsbury Mills, Inc. in *Springfield, Ill.* Contract is held by the Kaiser-Ducett Co., Chicago for $1,500,000 . . . More than $1,500,000 will be used to enlarge facilities of the Southern Bell Telephone & Telegraph Co. at *Memphis, Tenn.* . . . Corner stone of the Chicago Tribune's multi-million dollar building at Tribune Square *Chicago, Ill.*, was laid June 14 . . . Voters of *Lima, Ohio*, have approved a $3,000,000 bond issue for three new school buildings . . . Contracts have been let for a $543,550 hospital at *Coffeyville, Kan.* . . . *Greenville County, S. C.*, will vote Aug. 12 on a $1,500,000 bond issue for a county-city general hospital . . . A proposed $6,294,550 general hospital project at *Minneapolis, Minn.*, has won aldermanic and welfare board approval.

Housing—Construction of a $1,000,000 apartment development at *Everett, Wash.*, is about to be started by Paul N. Odegard, sponsor and contractor . . . Proposed construction of a rental housing project consisting of 184 apartments in the vicinity of Strong Memorial Hospital, *Rochester, N. Y.*, was disclosed recently. The project will be undertaken by a corporation to be organized by a group of mutual savings banks of Rochester. The plan proposes 27 residential-garden type apartment buildings of two stories each . . . Walter Antrim and Walter H. Thomas, Philadelphia, Pa., architects, announced plans for a $5,000,000 rental housing project in *Cheltenham Township, Pa.*

Water Supply and Sewers—*Columbus, Ohio* city council has authorized the order of plans from Paul A. Uhlman & Associates to enlarge the city sewage treatment plant's capacity from 42 mgd. to 55 mgd. Sewage treatment improvement plans call for a new air diffusing system, six sludge tanks and chemical treatment and settling basins. This work was recommended by Malcolm Pirnie, New York engineer, and the Uhlmann concern . . . Plans and specifications are being prepared for two North Side and West End relief sewer line in *Houston, Tex.*, to cost $3,000,000, and designed to eliminate the overflow of raw sewage into bayous. . . . Work is starting on the $500,000 Rossmoyne sewer project at *Cincinnati, Ohio* . . . Following a joint meeting of the *Santa Barbara, Calif.*, water commission and city council with Water Consultant Raymond A. Hill, the city has decided to abandon, at least fo rthis year, plans to raise Gibraltar Dam to double the water supply. The council voted to rehabilitate several emergency wells and use them during the summer if an emergency exists. Water Superintendent C. M. Pinkham urged repair of the wells after saying that the drain on Gibraltar Reservoir was 7 weeks ahead of the same period last year. The emergency wells have not been pumped for 16 years, except for maintenance.

Business men to confer on urban problems

Seeking the advice of community business leaders for guidance in development of the community, the Chamber of Commerce of the United States said last week that it would call a "Businessmen's Conference on Urban Problems" at Washington, D. C., on Sept. 11 and 12 of this year.

"While it is recognized that municipal officials have the final decision in the matter of increased traffic volume, lack of sufficient parking space, and a growing tendency toward decentralization," the Chamber said, "the fact remains that the business element of each community can perform a valuable service by participating in the consideration of various proposals and by helping to mobilize public opinion."

The conference program will be a discussion type, with a minimum of prepared addresses.

HELICOPTER DELIVERY

A helicopter will be used next month to transport men and equipment to the top of Mt. Cucamonga in southern California when construction starts on a building there to house television and FM transmission facilities. At present there is no road leading to the 8,900-ft. peak.

According to officials of the Broadcasting Co. of America, whose own construction division will erect the station, there is no road within eight miles of the site. A road will, however, be started soon, but it is not expected to be completed until the building is well underway.

Although the payload for the helicopter will be relatively small, the speed with which deliveries can be made will practically equal that of ground transportation. Cost will be somewhat higher, but it is essential that the building be started before the road would be completed.

Lumber price drop hits southern mills

A reported sharp drop in lumber prices throughout the South has caused widespread shutdown of small sawmills and reduced operations of many large operators, according to reports to Engineering News-Record.

Last January, roofers' lumber was selling at $80 per 1000 ft., and it is now reported selling at between $50 and $55 per 1000, with concentration yards and planing mills holding large inventories.

At a recent meeting of the Georgia Roofers Manufacturers' Association, at Macon, members said that thousands of small sawmills in the Southern States had shut down because of lack of demand for lumber and prospects are that many will not renew operations—this being especially true of the marginal mills and these started by newcomers who entered the field to take advantage of high prices earlier this year.

Admiral Combs to head R. P. I. civil engineers

Rear Admiral Lewis B. Combs has been appointed head of the department of civil engineering at Rensselaer Polytechnic Institute, Troy, N. Y., President Livingston W. Houston announced June 17. Admiral Combs succeeds Prof. Emil H. Praeger, now a partner of Madigan-Hyland, consulting engineers, New York City. The appointment becomes effective next January with Admiral Combs' retirement from the United States Navy in which he has served continuously since soon after his graduation as a civil engineer at R.P.I. in 1916.

From 1939 through the war years Admiral Combs was assistant chief and executive officer of the Navy's Bureau of Yards and Docks. He had a large measure of responsibility in organizing the Seabees and in directing the Navy's construction and expansion of 900 naval bases that cost more than $10,000,000,000 and increased the naval shore establishment to fifteen times its prewar size. Three hundred of the bases were overseas.

Following the war, Admiral Combs became director of the Atlantic Division of the Navy's Bureau of Yards and Docks with headquarters in New York City, a position he now holds. He is also a member of the staff of the commander of the Eastern Sea Frontier, a member of the staff of the commander in chief of the Atlantic Fleet, and a member of the Advisory Council for the Department of Civil Engineering, Princeton University.

Huge engineering college enrollments concern educators at annual meeting

Society for Engineering Education hears warning of increasing attendance and problems caused by it—Elects E. C. MacQuigg of Ohio State College as new president

The sheer weight of numbers of students seeking admission to engineering colleges poses the greatest problem facing college staffs and administrators, members of the American Society for Engineering Education were told last week.

More than 1,350 registrants at the society's 55th annual convention in Minneapolis, Minn., heard speakers marshal figures to show that about one in every nine college students will be enrolled in engineering courses by the end of the 1947-48 school year.

Delegates to the session heard numerous papers on problems of engineering education, approved by voice vote a resolution supporting universal military training, and elected Dean C. E. MacQuigg, of Ohio State College, as president for the coming year.

Dean H. P. Hammond of Penn State College, presenting a report of the committee on transfer of students from emergency colleges to engineering institutions, told his listeners that the number of students wishing to transfer to engineering schools, coupled with the ever-present problem of recruiting and holding adequate teaching staffs, present the colleges with their most serious problem.

"About 73,000 students were enrolled in engineering in 1945," Dean Hammond said, "but by 1946 the enrollment reached 225,000, and some 250,000 are expected in 1947. We may add to this the additional problem of how to handle some 90,000 students who will try to enter engineering colleges this fall with advanced standing, from liberal arts schools, junior colleges, emergency colleges and off-campus branches of parent institutions."

Other speakers at later convention sessions brought up the probability of a heavy increase in both undergraduate and graduate night school students, as veteran-students drop out of day school to take jobs, but continue their studies at night.

At the conclusion of the discussion, the group approved a series of remedial recommendations submitted by the committee, which propose:

Colleges should operate at full capacity, but should not admit so many students, lest sub-standard education result; that faculties and staffs devote a greater portion of their efforts to the upper classes and graduate students; that the society take steps to set up an agency for the exchange of teachers; that research and postgraduate work be continued at full efficiency to provide recruits for teaching staffs; and that the three-semester, or four-quarter, year be abandoned and return made to previous schedules.

Other activity

Many of the papers and addresses presented at the meeting stressed the increasing emphasis on international affairs in the work of engineers. Huber O. Croft, University of Iowa State, retiring president, called for a "deliberate and intensive" three-fold plan of training in engineering and science, national and civic service, and international understanding, as a means of "meeting educational demands in an atomic age."

Other speakers during the sessions included: C. A. Mockmore, of Oregon State College; J. B. Wilbur, M.I.T.; Harold E. Wessman, New York University; Scott B. Lilly, Swarthmore College; E. H. Gaylord, Ohio University; E. R. Wilcox, University of Washington; Norman J. Padelford, Massachusetts Institute of Technology, and A. M. Buchan, Washington University.

At the annual dinner meeting, the group confirmed the election of Dean MacQuigg as president, and of B. J. Robertsom of the University of Minnesota as vice-president and J. S. Thompson, chairman of the board, McGraw-Hill Book Co., as treasurer.

Dean S. S. Steinberg, University of Maryland, president-elect of the Engineering College Administrative Council, automatically becomes a vice president of ASEE.

Samuel T. Carpenter, chairman of the department of civil engineer at Swarthmore College, is the new head of the civil engineering division of the society.

The Lamme Medal of the society was awarded to Warren K. Lewis, professor of chemical engineering at M.I.T. and the George Westinghouse Award went to B. Richard Teare, Jr., head of the department electrical engineering at Carnegie Tech.

Bill removes construction controls

(*Continued from page* 53)

least 30 days after completion for veterans wishing to buy or rent. Total cost limit of the premium payment work has been set at $65,000,000.

At the time the conference committee was working out the final language of the bill, Mr. Creedon told the Washington Building Congress that the existing construction controls should be continued until next fall. Otherwise, he said the housing program might be reduced by over 200,000 homes. He said that $3,000,000,000 of non-housing construction was waiting to start with the removal of restrictions.

BLS makes gloomy report

The day before the Senate passed the rent control bill the Bureau of Labor Statistics issued a somewhat gloomy report on housing construction. BLS said that five months ago it was anticipated that approximately 1,000,000 permanent housing units would be placed under construction in 1947, but that the present outlook is for about 725,000 units. As against the original forecast of 950,000 completions, the bureau now anticipates that only about 765,000 units will be made available for occupancy this year.

Rising cost of construction was given as the reason for the cut. BLS's studies showed that the medium construction cost, not including land and the builder's profit, of the family homes begun in the first quarter of this year was about $5,250. One-fourth of the 1-family houses are costing private builders $7,250 or more.

All new construction in 1947 will total about $12,000,000,000 including $4,300,000,000 for housing, it is now estimated by BLS. This figure which tallies exactly with *Engineering News-Record's* estimate (*ENR* Feb. 20), exceeds last year's total by more than 20 percent.

However, BLS's appraisal of future construction prospects is based on the assumption that wholesale prices of building materials will decline about 10 percent by the end of the year, that wage rates on construction will rise only moderately, and that further modifications in the limitations on nonresidential building will be made by mid-summer. It is also assumed that there will be no major work stoppages and that materials inventories will continue to improve during the remainder of the year.

Urge engineering for highway safety

Engineering work can greatly reduce the great loss of life in Highway accidents engineers and highway officials were told at the President's Highway Safety Conference last week in Washington, D. C. Engineers must lead the fight, it was stressed, but at the same time they must keep the public interested in the execution of the programs developed.

At the opening of the conference, at which Maj. Gen. Philip B. Fleming of the Federal Works Agency president, President Truman said that the goal was to save 10,000 lives in 1947. Last year's conference (*ENR* May 16, 1946, vol. p. 766), was credited with considerable accomplishment.

Beginning in May last year, the highway fatality rate showed a sharp decline. The death rate in 1946 dropped to 9.8 per 100 million vehicle miles, as compared with a rate of 12 in 1941, he reported. Last year, the President estimated, 6,500 lives were saved by increased attention by engineers and the general public to safer highway traffic.

Wide-World Photo

Open Highway Meeting — *President Harry S. Truman greets Maj. Gen Philip B. Fleming at opening of the second President's Highway Safety Conference at the Interior Department Auditorium at Washington. Gen. Fleming acted as chairman of the meeting.*

Group prepares plan

The engineering committee, under the chairmanship of Gibb Gilchrist, president of Texas A and M College, outlined an 8-point program.

It called for coordinated safety activity by all groups of government officials, highway engineers, civic groups, educators, police, and planning groups.

It was suggested that each state draw up a long-range highway improvement plan, and that research traffic safety be increased. Coordination with the Highway Research Correlation Service would be important, the committee reported. Maximum use should also be made of the 1½ percent fund authorized in the 1944 Federal-Aid Highway Act for research and economic investigations.

All states that have not already done so were encouraged to revise their grade crossing laws along the lines of the 1944 highway act to provide for more equitable allocation of costs.

Enlargement and wider use of the on-the-job training programs already under way by some state highway departments was emphasized. Such work has proved successful and leads to safer highway design, construction, and operation, the advisory group said.

The last two recommendations of the engineering committee called for greater use of the access-control feature in highway construction and better reporting of highway accidents.

Connecticut wins award

The grand safety awards of the 1946 national traffic safety contest were presented to the state of Connecticut and to Omaha, Neb., and Washington, D. C. Connecticut's traffic death rate last year was only one half the national average.

Good progress was reported by local and state groups in holding safety conferences as recommended in the program of action adopted at last year's conference. As of May 1, 1947, 35 states had functioning coordinating committees of state officials, 28 had held statewide safety conferences, and 13 others planned similar conferences for 1947.

Thomas H. MacDonald of PRA reported that no national conference is planned for 1948. Instead, state meetings for advancing local programs will be urged.

Bill provides $15 million for flood control

Congressional action was completed June 19 on a bill authorizing the Corps of Engineers, U. S. Army, to spend $15,000,000 on emergency flood control construction in the Middle West. The measure permits the corps to use money now available with the understanding that this money will be replaced later with other appropriations.

Most of the money will be spent on the Mississippi River between St. Louis, Mo., and Keokuk, Ia., and on the Des Moines River in Iowa.

Natural Resources Dept. considered in Ohio

The Ohio Senate has passed and sent to the House a bill to unify Ohio's conservation activities, establishing a new state Department of Natural Resources, to include the existing Division of Conservation.

The department would be composed of the divisions of wild life, soil, water, forests, geological survey, beach erosion, and parks. Heading the new department would be a director appointed by the governor, and an 8-member advisory commission.

Gordon Fair in Europe on sanitation mission

Gordon M. Fair, dean of the graduate school of engineering of Harvard University and a member of the board of directors of the Rockefeller Foundation, arrived in London last week to undertake a study of sanitary engineering research and education in Europe. His report for the Rockefeller Foundation will be used by that group in planning its future engineering activities abroad.

Dean Fair's agenda call for visits to Paris, Zurich, Amsterdam, Stockholm, Warsaw, Helsinki, Oslo, as well as London. He is also scheduled to address the Royal Dutch Engineering Society at the Hague before his return the latter part of July.

Ray R. Zipprodt dies, was AISI consultant

Ray R. Zipprodt, 57, consultant for the American Iron and Steel Institute, died June 20 at Summit, N. J.

At his death, Mr. Zipprodt had been actively engaged in planning and supervising comprehensive researches in reinforced concrete. He was graduated in 1915 from the University of Illinois, with a B.S. in architectural engineering, performed investigations for the Joint Committee on Stresses in Railroad Track from 1915 to 1917, and then served as engineer of tests for the U.S. Shipping Board's Emergency Fleet Corp. From 1919 to 1920 he was associte engineer in charge of field investigations in reinforced concrete for the U. S. Bureau of Standards.

After continuous work for private employers from 1920 to 1936, Mr. Zipprodt became an associate professor of civil engineering at Columbia University, holding that post until 1940, when he joined the military planning division, Office of the Quartermaster General. He joined the AISI as a consultant in 1943.

ASTM approves membership dues rise, reveals formation of new committees

Chemist elected to head American Society for Testing Materials—Atlantic City meeting brings reports of increasing operation costs

Facing the prospect of rising costs and steadily expanding activities, the American Society for Testing Materials last week approved, subject to letter-ballot, the first raise in all classes of its membership dues in nearly 20 years.

The action was a part of a 5-day annual meeting at Atlantic City, N. J., last week, which saw the presentation of a great many papers on technical matters and the election of T. A. Boyd, a chemist and head of the fuel department, research laboratory division of General Motors Corp., as new president.

Society officers gave expanding operations, greatly increased printing costs and salary raises to staff members as the principal reasons for the increases in dues. Under the new schedule, rates for sustaining members would rise from $100 to $150; for companies, from $30 to $50; for individuals, from $15 to $18; for juniors, from $7.50 to $9, and for students, from $1.50 to $2. This would be the first dues increase for individuals since 1916, for companies since 1928.

Among new activities recently undertaken by the society in the construction field are the formation of a technical committee on Structural Sandwich Constructions (plastics, plywood, light metals, etc.) to develop test methods and specifications for composite materials; organization of a new Committee C-2 on Oxychloride Cement, and D-15 on Engine Anti-Freezes.

The Atlantic City meeting—50th annual convention of the organization—featured 19 technical sessions and more than 200 meetings of technical committees. Among the subjects of special interest to readers of this journal were: symposiums on load tests of bearing capacity of soils; measurement of entrained air in concrete; soils, cement, lime and concrete; plastic deformation of metals; identification of water-formed deposits; fatigue of metals and effect of temperature; and plastics and wood. Abstracts of some of these papers and the 21st Edgar Marburg lecture—delivered by W. C. Voss, head, department of Building Engineering and Construction, M.I.T.—will be given in a subsequent issue of *Engineering News-Record*.

While the various technical committees proposed many new standards, tentative specifications and revisions, few apparently will greatly affect commonly-used construction materials.

A possible exception is the new tentative minimum requirement for deformed reinforcing bars for concrete, advanced by Committee A-1 on Steel, to justify the higher stresses permitted deformed bars in concrete design. It is expected that within one year, all of the industry will be rolling bars conforming to the new specification, which limits size and spacing of deformation.

Recommendations submitted

Upon recommendation of Committee C-1 on Cement, "Tentative Method of Test for Heat of Hydration of Portland Cement (C186-44T)" was adopted. "Standard Specifications for Portland Cement (C150-46)" was revised to make manufacture of Type V cement a more practical and economical procedure in closer accord with federal specifications SS-C-192. Other revisions affected "Tentative Specifications for Portland Blast-Furnace Slag Cement (C205-46T)", permitting intergrinding of TDA—a product of Dewey and Almy Chemical Co.—with clinker and slag; and "Tentative Specifications for Air-Entraining Portland Cement (C175-46AT)."

Committee C-9 on Concrete and Concrete Aggregates, announced preparation of a proposed tentative method of evaluation of air-entraining admixtures, and its proposed sonic method of test for computing modules of elasticity of concrete specimens was approved as tentative. "Specifications for Ready-Mixed Concrete (C94-47T)" reverted from standard to tentative, upon revision to include use of non-agitating equipment.

Committee D-4 on Road and Paving Materials, and D-18 on Soils for Engineering Purposes, gained approval of two methods of tests as tentatives. One was for shear strength of flexible road surfaces, subgrade and fills by the Burggraf shear apparatus (*Bulletin No. 10* American Road Builders Assn., 1940) and the second was for soil-bituminous mixtures. "Tentative Specifications for Standard Sizes of Coarse Aggregates for Highway Construction (D448-42T)", "Tentative Specifications for Tar (D490-43T)", and "Tentative Specifications for Crushed Stone, Crushed Slag and Gravel for Bituminous Concrete Base and Surface Courses of Pavements (D692-42T)" were adopted as standards—the last with some revisions.

On advice of Committee D-8 on Bituminous Waterproofing and Roofing Materials, "Standard Specifications for Asphalt-Saturated Roofing Felt (D226-44)" and "Coal-Tar Saturated Roofing Felt (D227-44)" were revised to conform with new standards agreed upon between the roofing industry and the Division of Simplified Practice of the U. S. Department of Commerce and those that have been accepted by the Underwriters' Laboratories and the Federal Specifications Board. Tentative Specifications for Asphalt-Saturated Asbestos Felts (D250-44T) and Asphalt Saturated and Coated Asbestos Felts (D655-44T) were adopted as standards.

Other action included: Adoption as standard "Tentative Method of Test for Cement Content of Soil-Cement Mixtures (D806-44T)"; approval as tentative a test for field determination of density of soil in place; approval as tentative specifications for aluminum and aluminum-alloy extruded bars, rods and shapes; approved as standard "Tentative Method for Test for Combustible Properties of Wood by the Fire-Tube Test Method (E69-46T)"; approved reversion to tentative upon revision of "Standard Methods of Sampling Plant or Confined Waters (D510-41)".

Officers and awards

Other new officers of the organization, in addition to Mr. Boyd, included: J. G. Morrow, metallurgical engineer for the Steel Co. of Canada, as vice-president.

The Sanford E. Thompson Award for a paper of outstanding merit on concrete and concrete aggregates was given to William Lerch, research chemist of the Portland Cement Association. F. B. Quinlan, metallurgical section, works laboratory, General Electric Co., received the Richard L. Templin Award.

Army announces contract for $9 million dredge boat

A new hopper dredge, to cost about $9,000,000 and to be the world's largest unit of its type, is to be built for service in New York Harbor, the Corps of Engineers said last week.

Col. W. F. Heavey, New York District Engineer, announced that low bidder on a contract for the new dredge was the Sun Shipbuilding and Dry Dock Co., of Chester, Pa. The new boat will be 50 ft. longer than the 476-ft. "Goethals" which now operates in New York Harbor, and new capacity will be 8,000 cu. yd. of material as against the "Goethals'" 5,000. The new vessel will have accommodations for a crew of 110 men.

Delivery is scheduled within two years of award of the contract. The vessel will replace two smaller dredges that have been in service since 1906.

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

A summary of current activities in city engineering and construction

San Francisco board approves first reading of controversial building code revision—Omaha, Indianapolis announce major airport programs—Other city affairs

The San Francisco Board of Supervisors last week gave first passage to a long-debated building code revision, overriding heated opposition from engineers, contractors and builders.

Most vigorously contested as "uneconomical and impractical" are provisions to strengthen tall buildings against earthquake shocks that engineers claimed would so increase the cost of construction as virtually to prohibit further building of large structures in the city.

The lateral force for which the code provides, figured as a percentage of gravity, is C, where $C = 2/(24 + N)$ and N is the number of stories, counting from the top of the building to the plane under consideration. The minimum value of C is set at .04 on a curve starting at .08. For theaters, the value of C is set at .10, the allowance being for a horizontal force of 0.1 g.

Representatives of the San Francisco section of the ASCE and the Structural Engineers Association of Northern California contended that a curve of from .04 to .02 would offer sufficient protection. H. J. Brunnier, consulting structural engineer, protested that the lateral forces sections would add 100 percent to the cost of the steel framework for a skyscraper, and added that "not a building in the city" can meet the specifications set by the revised code.

Harry C. Vensano, public works director under whose direction the code was drawn, denied charges that steel framework costs would be doubled and claimed the overall increase in building costs would be only 1.5 percent. "It is the city's duty to give adequate protection to its citizens," he added.

Street problems

Columbus, Ga., officials have before them a recommendation from an outside consulting engineer that the city launch a 20-year, $10,000,000 street improvement program to ease the flow of traffic. Included in the recommendations was a suggested ordinance to require future buildings to be built with adequate off-street loading and parking facilities.

Pittsburgh, Pa., councilmen viewed legislation to create a city parking authority to build and operate off-street parking facilities; Akron, Ohio, councilmen approved authorizations for preparation of plans for an extension of Lake Shore Drive. Fostoria, Ohio, crisscrossed by several major railway lines, announced that a $3,500,000 grade-crossing elimination program would get under way within a year.

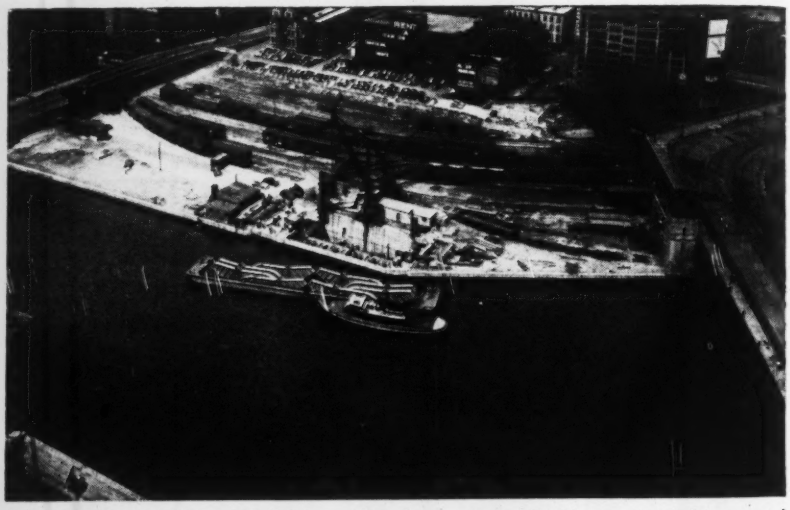
Airport plans

The Omaha, Neb., Airport Commission last week was considering a $4,547,000, 3-year program for modernization and enlargement of its municipal airport to accommodate an expected total of 625,000 passengers a year by 1950.

The report was submitted by the General Airport Company of Stamford, Conn., after a survey made at the commission's request. The proposal calls for lengthening and widening existing runways and construction of several new ones, construction of a new terminal and administration building.

At Indianapolis, Ind., the City Aviation Commission planned a series of meetings to determine final location of a $500,000 administration building for Weir Cook Airport, and for other improvements to the field. And in New York City, the Port of New York Authority, which recently took over operation of the city's LaGuardia, Floyd Bennett and Idlewild airfields, announced that Hervey Law—former manager of the National Airport at Washington, D. C., would direct the airport program for the authority.

Preliminary cost estimates of the first stage of construction for the $765,000 airport improvement program at the New Castle County, Del., airport were submitted June 3 to the Levy Court and the County Airport Commission. A preliminary airport master plan has been prepared by M. W. Cochran, airport consulting and designing engineer for Detroit, Mich.



Girders for Chicago Bridge *—Too large for rail shipment, eight curved trunnion-supported girders, each weighing 67 tons, arrived by barge at the site of Chicago's new North State Street Bridge, after fabrication at the American Bridge Company's Gary, Ind., plant. The new bridge, fifth at the same crossing in 82 years, will be a 3-truss, railing-height, double-leaf trunnion bascule structure of the Chicago type, with a width of 108 ft. (including two 36-ft. roadways) and a clear span across the river of 210 ft. Contractor is the Overland Construction Co., erection is under general supervision of W. W. DeBerard, city engineer, and Stephen J. Michuda, engineer of bridges.*

California Approves new anti-smoke law

Los Angeles most benefitted by new act—Salt Lake City to ease ban on steam locomotives

California's "Anti-Smog" bill—an amendment to the state health and safety code—became law this month, after it was signed by Gov. Earl Warren. Concerned with smoke, dust, noxious gases, industrial waste fumes released into the air, it sets up a uniform state-wide control system.

Enforcement will be handled by "air pollution control districts" coinciding with county boundaries. The bill delegates certain state police powers to boards appointed by the county supervisory bodies and supercedes the authority of incorporated cities except insofar as these incorporated units may enact ordinances more stringent than the state law.

Most affected by the bill is Los Angeles where the first ordinance in California regulating the discharge of fumes and smoke into the air was enacted by the city council in 1905, to prohibit emission of dense smoke from chimneys and stacks for periods of more than 10 consecutive minutes. This ordinance was revised in 1907 and again in 1911, but not until fumes from wartime butadiene plants became a health menace in 1942 was any further action taken.

A set of standards has been established by which to judge violations. It prohibits the emission of air contaminant for a period of more than 3 minutes in any one hour, if the contaminant is "as dark as or darker than No. 2 on the Ringlemann Chart as published by the U. S. Bureau of Mines."

Exemptions are allowed for the purposes of weed abatement or prevention of a fire hazard and specifically exempted are orchard heaters.

Salt Lake eases ban

Officials of Salt Lake City, Utah, presented to railroad officials a plan to delay for one year the effective date of a city ordinance banning steam locomotives within the city limits. The measure had been scheduled to become effective Aug. 1.—(*ENR* June 19, vol. p. 978).

City Streets Commissioner John B. Matheson told railway officials that the city was impressed by the 50 percent reduction in railroad-caused smoke in the first five months of this year.

He set five conditions on the city's offer to hold up enforcement of the ordinance for one year:

Eliminate steam locomotives for switching and transfer purposes in the city and Roper yards; equip with induction tubes all coal burning locomotives entering the city; transfer from the city all locomotives not adaptable to induction tube installation; install mechanical firing equipment in all hand-fired stationary machinery located in city limits, and preheat oil fuel before lighting locomotive fires.

State court upholds anti-closed shop law

Nebraska judge rules state's new law constitutional in the first judgment rendered on the new legislation

An anti-closed shop constitutional amendment, challenged by labor unions in court actions, was declared valid in Nebraska District Court last week.

The decision was the first in a series of similar suits brought in other states by representatives of national labor organizations seeking to defeat legal provisions which prohibit closed shops and other union practices.

District Judge Ralpn Wilson of Lancaster county, Nebr., in an oral declaratory judgment, said that the amendment adopted last November by Nebraska voters is "a valid and proper exercise of the state's police powers." He held that it did not infringe upon or violate any provisions of the federal constitution or of the National Labor Relations Act.

He added that the amendment invalidated existing contracts containing closed shop provisions, and consequently the contract around which the test case was developed.

The suit was brought last February by the American Federation of Labor, the Nebraska Federation of Labor and an Omaha Iron and Metal Workers Union, against the Northwestern Iron and Metal Co., the state, and an employee of the company, over the refusal of the company to discharge the employee after he had failed to maintain membership in the union.

Commenting on the ruling, Judge Wilson said that the principal question involved was whether the amendment constitutes "an undue exercise of the state's police powers and, secondly, whether it violates the National Labor Relations Act." Labor attorneys had argued that the bill did transcend the limits of police powers because the amendment went beyond its objective—it went too far in its attempt to regulate some admittedly bad labor practices.

Union attorneys indicated that the matter will be taken through higher state courts and to the United States Supreme Court for final decision.

Jesse Baker Snow dies; tunnel building expert

Jesse Baker Snow, 79, former chief engineer of the New York City Board of Transportation and one of the foremost tunnel engineers, who supervised or was otherwise connected with most of New York's under-river rapid transit tunnels, died June 16 at Great Neck, N. Y.

Born on the island of Nantucket, Mr. Snow received a civil engineering degree from Union College in 1889. His first work was sewer and street railway surveying and designing in Goshen, N. Y., West Superior, Wis., and Long Island City, N. Y. In 1905, after engaging in other engineering work, he began his long experience in tunnel construction. Until 1910 he was associated with the Pennsylvania, New York & Long Island Railroad Co. and its successor, the Pennsylvania Tunnel and Terminal Railway, in the construction of the Pennsylvania Railroad tube under the North River from Manhattan to Jersey City, serving under Alfred Noble.

From that time, Mr. Snow's record chronologically is as follows:

1910-1914 In general practice including work on dam construction and plants for hydro-electric development in Canada and Montana.

1914-1919 Resident engineer for the Public Service Commission on construction of the East River tunnels.

1919-1921 Principal assistant engineer for the N. Y. State Bridge and Tunnel Commission, the N. Y. and N. J. Interstate Bridge and Tunnel Commission, and principal assistant engineer planning the Holland Tunnel.

1921-1924 Tunnel engineer, New York City Board of Estimate, on plans for the Narrows Tunnel.

1924-1934 One of the engineers for the N. Y. City Board of Transportation, supervising various subway tunnels.

1934-1945 Chief engineer of the Board of Transportation until retirement. He also served as consultant on the Queens-Midtown Tunnel.

MAJOR MEETINGS

American Society of Civil Engineers, 75th annual summer convention, Hotel Duluth, Duluth, Minn., July 16-18.

American Water Works Association, 67th annual conference, jointly with Federation of Sewage Works Association, 20th annual meeting, Civic Auditorium, San Francisco, Calif., July 21-25.

Federation of Sewage Works Associations, jointly with American Water Works Association. See above.

American Congress on Surveying and Mapping, 7th annual meeting, Statler Hotel, Washington, D. C., August 14-15.

ENGINEERING SCHOOL NEWS

New hydraulic engineering course at Louisiana—Wisconsin offers correspondence courses in structural engineering—Social-humanistic studies recommended at Syracuse

At the beginning of the 1947-1948 school session, Louisiana State University, Baton Rouge, will open a school of hydraulic engineering as a division of the college of engineering. Work leading to the master of science degree will be offered.

Normally, the requirements for this degree can be fulfilled in one 12-month year. Some of the students may remain at the university for the full period, but by agreement with the Corps of Engineers the rest will be assigned to the U. S. Waterways Experiment Station, Vicksburg, Miss., for four months, to work on at least three different types of laboratory projects.

Courses at the school will include experimental hydraulics, hydrology, drainage and irrigation, flood control, hydraulic machinery, levee design and practices, waterways transportation, research in hydraulics, hydraulic problems, water power engineering, design of hydraulic structures, and advanced hydraulics.

Three of the four staff members have been appointed, as follows:

Glen N. Cox, director, who received training at the University of Iowa and the University of Wisconsin and has been on the faculty at Louisiana for several years, formerly professor and head of the department of hydraulic engineering.

S. E. Lawrence, professor, who trained at Purdue University, and spent many years with the U. S. Engineers in rivers and harbors work, and in private practice.

Vladas Merkys, assistant professor, who was trained in Russia, France and Germany and has practiced and taught hydraulics through most of his lifetime.

Applicants for admission must have obtained the bachelor degree in the upper third of the graduating class and in an engineering curriculum approved by the Engineering Council for Professional Development, although students lacking some of the foregoing requirements may be accepted after due consideration. Inquiries are to be sent to Glen N. Cox, director.

Several revised correspondence courses in structural engineering, taught by the extension division of the University of Wisconsin, now are available to enrollees in any state or country. They are offered for men in the field of building design and construction and for others whose work calls for an analysis of the forces in simple structures.

"Plain Concrete Construction," now expanded from eight to 16 lessons, covers the design of concrete mixes, estimating materials, and the use of plain concrete.

"Essentials of Structural Theory" as revised provides a simplified, comprehensive treatment of the basic principles. It treats of the theory and actual design of beams and columns and the determination of stresses in ordinary framed structures. A good working knowledge of algebra and trigonometry is required.

The department of civil and structural engineering in the University Extension building at Madison, Wis., answers inquiries.

A committee from the faculties of the College of Applied Science and the College of Liberal Arts at Syracuse University has made recommendations for social-humanistic studies in the former college as follows:

Freshman Year:

English composition and literature. Some practice in public speaking. Prescribed summer reading.

Sophomore Year:

Basic principles of psychology. As an aid to an understanding of human behavior.

Junior Year:

Principles of economics. Main characteristics of our industrial system. Problems of production, exchange, distribution and consumption of wealth.

Senior Year:

(a) Modern history, with emphasis upon historical trends and movements.
(b) Social philosophy, in its relation to modern social problems.

The faculty is also giving consideration to establishing 5-year curricula. If adopted, this plan will make it possible to include more time for general subjects without sacrificing those deemed essential for the engineering courses.

The college of engineering of Cornell University has been left the bulk of the estate of Horace Evan Sibson of Philadelphia, Pa., estimated at about $300,000. Mr. Sibson, who died last September, was graduated from Cornell in 1903.

Sir James Dunn, of Algoma Ore Properties, Toronto, Ont., has provided scholarships to the value of $20,000 for engineering students at the University of Toronto. Six 4-year $800 scholarships will be available for outstanding students entering first year, and graduate fellowships totalling $4,400, for advanced students.

***Excavating Oddity**—An ingenious combination of an earth loader and a travelling belt-conveyor stacker, that deposits spoil 100 ft. from the point of excavation, this odd-looking combination of machines is at work on a section of the Friant-Kern Canal, in California. The stacker is a trussed section 100 ft. long, carrying a 60-in. belt, supported on two swivel-head crawler carriages. Each carriage is pulled by a tractor. A third tractor pulls the loader, which discharges into the hopper. The machine was built by Guntert and Zimmerman, Stockton, Calif., for Arizona-Nevada Constructors, Inc., and has reached a maximum capacity of 1,780 cu. yd. per hour.*

OBITUARY

Harry Danforth Symonds, 72, engineer, builder and contract manager of the George A. Fuller Co., New York, died in Orange, N. J., June 16. During a 45-year career, Mr. Symonds was associated with many construction firms and once headed his own company. Between 1925 and 1932 he was vice-president of the Fuller company, and he had supervised most of that company's large projects in the last 30 years. These included the N. Y. County Court House, the Savoy Plaza Hotel, New York, the Blackstone Hotel and the Dodge war engine plant in Chicago; and the Hotel Nacional in Havana, Cuba. Mr. Symonds had once estimated that during his career he had estimated and supervised $1,250,000,000 worth of construction.

John Knickerbocker, 81, an engineer and director of several railroad companies, died at Ballston Spa, N. Y., June 16. He received his civil engineering degree from Rensselaer Polytechnic Institute in 1886. He was a director of the Stillwater and Mechanicville Street Railway Co. and also of the Troy and New England R.R. Co. of which he was president at one time.

J. Alfred Burnett, 63, engineer with the street cleaning department of Toronto, Ont., for the last 33 years, died in Toronto on June 9.

James G. Osborn, 59, former resident engineer of the Akron, Ohio waterworks plant, and also a former city engineer of Kent, Ohio, died in Akron on June 7.

Robert Clinton Watts, 71, Columbus, Ohio, who was a civil engineer with the Ohio Highway Department, having retired five years ago, died June 11. He had spent 20 years as engineer with the Ohio Paving Manufacturers Association. He was a veteran of World War I, a first lieutenant with an Army Engineer battalion.

George C. Habermeyer, 70, professor of civil engineering, University of Illinois for 18 years previous to his retirement in 1929, died June 11 at Yorkville, Ill. He had been a consulting engineer since his retirement from the university.

Fred L. Cumming, 64, an engineer with the state highway department at Helena, Mont., died recently at Spokane, Wash. Mr. Cumming joined the engineering staff of the highway commission in 1935 after a long career, beginning in 1911, with the United States Geological Survey.

Charles M. Crawford, 60, former civil engineer for the Reconstruction Finance Corporation, at Louisville, Ky., died in Greenville, S. C. June 10.

Rog Jablonsky, 55, highway engineer for St. Louis County, Mo., most of the time since 1924, died in St. Louis June 13.

Robert S. Paden, 53, an engineer for the Illinois division of highways, died at East St. Louis, Ill., June 10.

Stewart T. Smith, 56, structural engineer, Stone & Webster Engineering Corp., Boston, Mass., died at Wellesley, Mass., June 10. Mr. Smith was a graduate of the University of Illinois, 1916. He was chief engineer in charge of design of the new Children's Hospital Center, Boston.

Syrill Datson, 40, of Tallahassee, division engineer for the Florida State Road Department, was killed in an automobile accident near West Palm Beach on June 10.

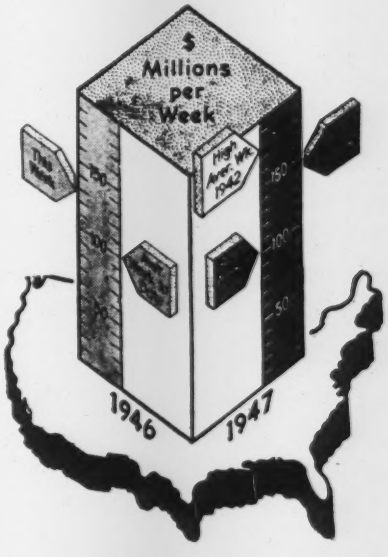
William A. Goff, president of William A. Goff, Inc., consulting engineers of Philadelphia, Pa., and Camden, N. J., died June 9. A graduate of Drexel Institute of Technology, Mr. Goff participated in construction of many Army and Navy projects during the war.

William H. Burns, 61, general superintendent of Washington-Oregon railroad construction for the Morrison-Knudsen Co., died May 26 at Spokane, Wash. He served as construction engineer and supervisor on three of that company's dams—Glenville, Anderson and Dale Hollow.

L. R. Stockman, 71, of Baker, Ore., one of the foremost sanitary engineers of the Pacific Northwest, died June 5. Born in Wisconsin, he had lived in Baker for 34 years and had designed many sewage disposal plants in Oregon, Washington and Idaho.

Andrew Robert Porter, 90, president of the Portland, Ore., general contracting firm of Porter Bros. since 1912, died June 7. His firm constructed two of the world's largest ocean terminals at Norfolk, Va., and Halifax, Nova Scotia; the under-river tubes between Detroit, Mich., and Windsor, Ont., and sections of the Great Northern railroad between Havre, Mont., and Seattle, Wash.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of June 26 1947	Cumulative 1947 (26 wks)	Cumulative 1946 (26 wks)
Federal	$40,892	$331,938	$313,702
State & Mun.	33,488	799,492	639,745
Total Public.	$74,380	$1,131,430	$953,447
Total Private	69,090	1,542,435	1,678,739
U. S. Total.	**$143,470**	**$2,673,865**	**$2,632,186**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (26 wks)	Cumulative 1946 (26 wks)
Waterworks ..	$2,271	$55,627	$46,316
Sewerage	7,141	64,171	45,813
Bridges	4,064	81,786	63,937
Highways	15,277	378,185	358,836
Earthwork, Waterways	22,488	156,940	194,714
Buildings, Public	8,255	252,419	162,959
Industrial ...	21,841	388,629	526,915
Commercial ..	28,198	912,168	1,042,741
Unclassified ...	33,975	383,940	189,955

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (26 wks)	Cumulative 1946 (26 wks)
NON-FEDERAL $889,245		$509,078
Corporate Securities 337,768		196,391
State and Municipal 551,477		312,687
FEDERAL		158,320
Total Capital $889,245		**$667,398**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	June'47	403.29	193.86
Building Cost	June'47	303.14	163.87
Volume	May'47	224.	98.

EDITORIALS

VOLUME 138 NUMBER 26

June 26, 1947

As Others See Us

IT IS ALWAYS INTERESTING, and frequently enlightening, to get a glimpse of ourselves through the eyes of others. In this connection the observations of Nikolai Bassov, of the U.S.S.R., only engineer on the board of design for the United Nations headquarters, focused attention on a situation in this country that called for the qualifying adjective "remarkable". Mr. Bassov was referring to the cooperative relationship that exists between engineers and the producers of building materials and construction equipment. He pointed out that it is these manufacturers, "inspired by the genius and demands" of the engineers, who turn out products that make possible the execution of great works. Thus, what we in this country have taken for granted, is termed a remarkable achievement by a foreign observer. All of which should be very heartening to engineers and manufacturers whose efforts have resulted in such an effective working partnership in the building industry; without laboring the point, it might also be said to reflect some credit on the competitive enterprise system under which we operate.

An Expensive Luxury

ARGUMENTS for the construction of toll roads are presented in the "Comment and Discussion" pages of this issue by Enoch Needles, whose firm is in charge of the design and construction of the Maine Turnpike. Few people will deny that a toll road, or a toll bridge, can be justified at certain locations or under special conditions. And it is true that the public appears to support some of the arguments in favor of toll roads by its willingness to pay a fee for the convenience of a safe high-speed highway even when a free road is available, as in the case of the Pennsylvania Turnpike and the Merritt Parkway in Connecticut. But in any discussion of toll roads it is important to recognize that some of the conditions that appear to justify the construction of such roads are due to inequitable distribution or use of highway-user taxes. For example, had Connecticut received a more equitable share of federally-collected motor-vehicle taxes in recent years, the state could have built the Merritt Parkway without resort to tolls. And regardless of justifying circumstances, the fact remains that any toll road is an expensive luxury. Points of access must be limited in order to minimize toll-collection costs, thus reducing the usefulness of the road, and the cost of collecting the tolls continues indefinitely as a tax.

Pressure-Group Economics

CONGRESSMEN are to be commended for the patience with which they listen to the prejudiced arguments that are made for and against projects under consideration by legislative committees. Good examples can be found among the statements made at the current hearings with respect to the St. Lawrence Waterway. The mayor of New Orleans recently told the committee that the plan to modernize the St. Lawrence ship canal was economically unsound and that it would adversely affect the "nation's greatest river valley and its gateway port of New Orleans". The mayor appears to have overlooked the fact that it was only through the expenditure of federal funds in amount probably exceeding the cost of the navigation facilities for the St. Lawrence Seaway that traffic now moves up and down the Mississippi and its tributaries to the "gateway port of New Orleans". With equal disregard for realities and crysal-clear logic, proponents of the seaway project have compiled statistics of potential traffic that leave no doubt in their minds as to the economic soundness of the undertaking. Congressmen can hardly be blamed if they become weary in sifting the grain out of all this chaff.

Big Opportunity in a Small Job

WORKING on a small construction job or with a small engineering organization frequently offers to the new engineering graduate greater opportunities for professional development than does a job on one of the bigger construction projects. With a small organization the young engineer is thrown into intimate contact with all phases of the operation—specifications, purchasing, inspection, survey and planning. In large organizations, where specialists predominate, it is not unlikely that the cub must be content with a single task, such as plotting cross-sections or giving line and grade. Looking toward the future, the young engineer will find that there is greater likelihood of applying the general knowledge acquired on a small job to a large one

than to fit the specialized experience of a large job to a small one. There is a great advantage in starting where you can assume responsibility early.

Competitive Engineering Prosposals

RECONSIDERATION of the restrictions on competitive proposals for engineering work that are contained in the codes of ethics of professional societies was urged in these pages recently (*ENR* Jan. 9, vol. p. 33). At that time, space limitations did not permit of more than a review of conditions indicating that those restrictions are unrealistic, resulting in widespread violation of the spirit if not the actual letter of the codes.

Widespread violation of codes of ethics and tacit approval of such violation by committees set up to enforce the codes point to a condition calling loudly for correction. Either the professional societies should take disciplinary action against the violators, or they should modify the restrictions now in the codes that result in the violation. As the present actual or implied restrictions against competitive proposals are unsuited to existing conditions, the latter appears to be the only logical procedure. To that end, we suggest the following changes as the basis for discussion:

(1) Permit engineers to submit competitive proposals for engineering engagements under conditions prescribed by the engineering societies.

(2) Make the conditions under which competitive proposals are permitted such as to minimize the possibility of an award being made on the basis of price alone.

This latter proposal does not appear to be as unattainable as many engineers believe it to be. For example, if the rules required that all proposals be in writing to be publicly opened and read on a given date, and if they specified that each engineer submitting a proposal must include with it an outline of his qualifications, a detailed statement of the services he proposes to render and the amount of his fee, then the public official charged with responsibility for engaging the services of a competent engineer will have something other than price on which to make a decision.

It appears probable that there would be no more competition on the basis of price alone under such a system than there is in the present widely accepted system under which representatives of a city discuss its engineering needs with a number of engineers and ultimately engage one after negotiations that may extend over a considerable time.

Further, as most of the state and national societies now have schedules of minimum fees in their codes of practice, the amounts of the fees asked should not be far apart, if those schedules are observed, hence the competition would be chiefly on the basis of qualifications, where it rightly belongs.

One of the chief arguments against competitive proposals is that they open the way for an unscrupulous engineer to step in and take the job at a fee so low that he could not possibly render a satisfactory job for his price. The possibility of that actually happening appears remote, but it is worth observing that once a system is set up under which all details of the proposals will be a matter of public record, an engineer whose proposed fee is conspicuously low will immediately be in the spotlight.

And it is here that developments since the present codes of practice were written may come into play. Since those codes were written, every state has set up a board of engineers to pass on the qualifications of engineers permitted to practice in that state. Most states also have organizations made up of licensed engineers who have banded together for the purpose of seeing that the license law is strengthened and enforced.

Keeping a watchful eye on proposal for engineering engagements in connection with public work should be one of the chief functions of the state societies. A proposal far below that indicated by the state society's schedule of fees could immediately be challenged, and if the engineer who made the proposal could not satisfy the society as to his capacity to do an adequate job for the amount of his fee, or if he showed that he lacked qualifications to do the work, the state license board could be asked to revoke his license.

No claim for perfection or completeness is made for the system outlined in the foregoing, which is put forward primarily as a basis for discussion. It appears to have merit in that it should eliminate some of the known defects of the present system without sacrifice of fundamental principles.

ENGINEERING NEWS-RECORD
Copyright, 1947, by McGraw-Hill Publishing Company, Inc.
WALDO G. BOWMAN, *Editor*, EDWARD J. CLEARY, *Executive Editor*
New York: V. T. BOUGHTON, R. K. TOMLIN, H. W. HUNT, E. E. HALMOS JR., T. D. MacGREGOR, JOHN C. BUMSTEAD and F. S. MERRITT
Chicago: V. B. SMITH, *Cleveland:* J. R. CARR, *Washington:* A. N. CARTER, *San Francisco:* N. A. BOWERS, L. L. WISE
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

Work of Public Roads Research Laboratory

***Contents in Brief**—Projects under way in the research laboratory of the Public Roads Administration vary from development of a new immersion-compression test for evaluating the durability of bituminous pavements to the preparation of engineering soils maps by use of aerial photographs and the combining of information from geologic and pedologic maps. Work pertaining to Portland-cement pavements includes the use of ultra-violet light to evaluate the alkali reactivity of various types of aggregates and extensive studies aimed at improved use of air-entraining cements. A large oval test track is being built as part of the long-range program to develop rational methods of designing non-rigid pavements. Special equipment in use on other structural research includes a machine to apply dynamic loads to concrete specimens and a "roughometer" for measuring the relative roughness of highway pavements.*

IN KEEPING with the large road-construction program that is now getting under way, the research laboratory of the Public Roads Administration is expanding several phases of its work and is initiating a number of new studies. Improved specifications are being prepared, several pieces of special equipment are in use and considerable original research is in progress. Work of the laboratory is not only expected to reduce construction costs but to make future highways better and safer.

The research station is a part of PRA's department of research. The laboratory is located in Arlington County, Va., adjacent to the national Airport. About 100 people are employed, the greatest percentage of whom are engineers and technicians.

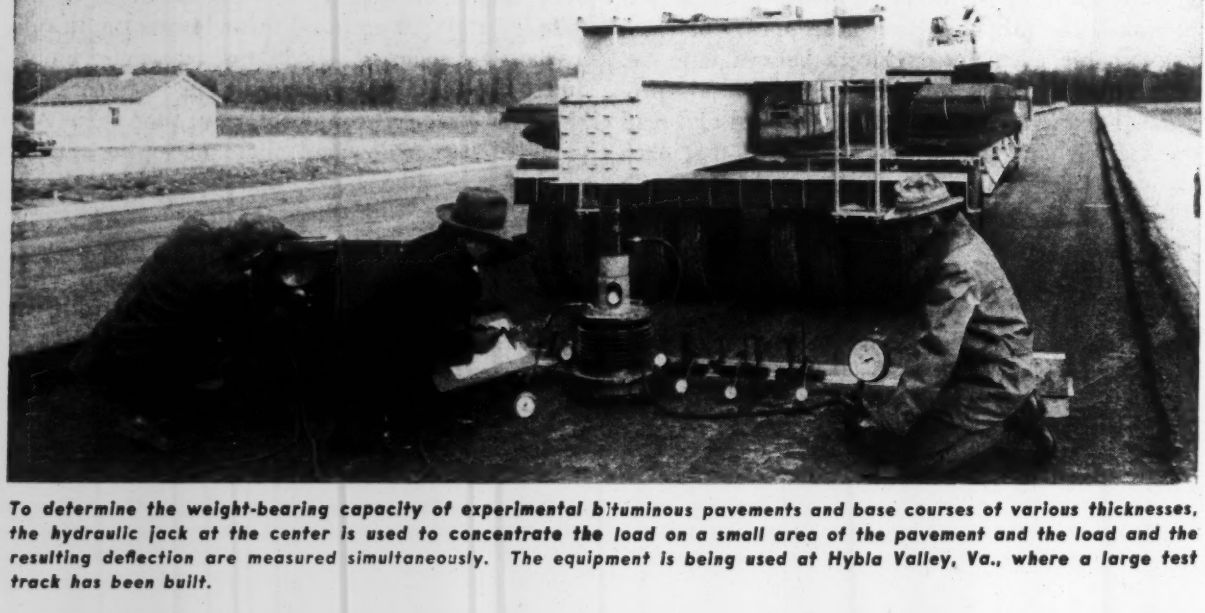
Some research pertaining to highways has been carried out by the federal government ever since 1893, when the Office of Road Inquiry was established in the Department of Agriculture. Added impetus was given to this activity with passage of the federal-aid highway acts of 1916 and 1921. The expanded program created by the Federal-Aid Highway Act of 1944, which provides $500,000,000 of federal road funds for each of the first three postwar years, places a correspondingly increased responsibility on the station to assure maximum benefit from the construction money.

The basic purpose of the work of the station is to gain a better understanding of road materials and their use. For the most part, projects approved must be of wide interest. With the exception of certain continuing long-range studies, such as those on soil properties, the projects deal with problems of immediate or current concern.

The work is carried on by four sections each of which specializes in one of the following classes of subjects: Bituminous materials and mixtures; cement, aggregate and concrete; soil studies; and investigations relating to structural design.

Work of bituminous section

One of the outstanding current activities of the bituminous section is a comprehensive study of the stripping of bituminous coatings from aggregates in bituminous pavements. Wide



To determine the weight-bearing capacity of experimental bituminous pavements and base courses of various thicknesses, the hydraulic jack at the center is used to concentrate the load on a small area of the pavement and the load and the resulting deflection are measured simultaneously. The equipment is being used at Hybla Valley, Va., where a large test track has been built.

differences in the ability of different aggregates to retain a bituminous coating in the presence of water have been indicated and a new test for evaluating the resistance of bituminous paving mixtures to the effect of water has been developed.

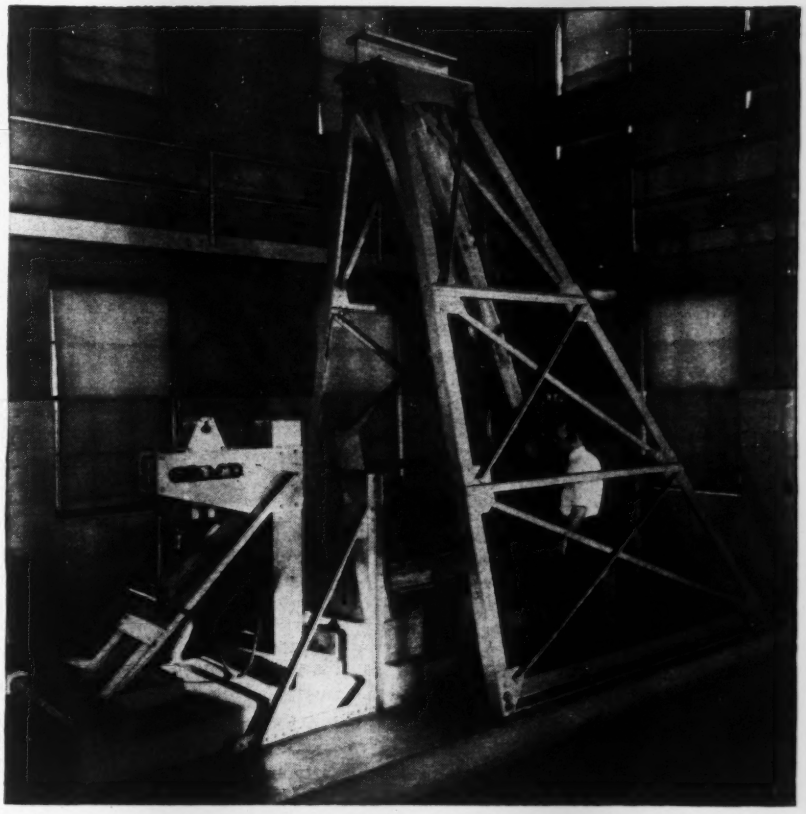
This new test, certain phases of which have also been the subject of considerable research in Ohio, is under consideration by the American Society for Testing Materials as a possible tentative standard. The new method is expected to answer a long felt need for a test for the durability of coarse-graded bituminous mixtures, since no satisfactory procedure has previously been available for evaluating quantitatively the resistance of bituminous mixtures to the damaging effect of water entering the consolidated pavement structure.

The new test procedure consists of two major parts: (1) a simple compression test without lateral support of molded cylindrical specimens to determine the load supporting capacity of the compacted mixture in the optimum or unweathered state, free of water; and (2) immersion of companion specimens in water baths of various temperatures for periods of four days or more, followed by compression tests to determine the softening effect due to soaking. The resistance of the material to the destructive action of water is revealed by comparing the strength of the soaked specimens with that of the dry ones.

A report on the development of the immersion-compression test was presented in February at the annual meeting of the Association of Asphalt Paving Technologists. This report, which was prepared by J. T. Pauls and J. F. Goode, both of the PRA, will be published in the association's proceedings at an early date.

Additives get attention

During the war, PRA research engineers aided the Corps of Engineers in studying the use of stone that had severe stripping characteristics. As reported in *Public Roads* for July-Aug.-Sept., 1945, p. 131, some eight additives were investigated in detail. The additives studied included those containing metallic soaps, fatty acids or amines, and synthetic resinous agents. Some additives appeared to be very beneficial in preventing film stripping, and the work of studying these agents as well as new products is being extended. In keeping with the beneficial results indicated by investigations already completed, some state highway departments are already trying out the additives on actual construction.



By simulating the effect of a wheel load on a slab corner, this large pendulum machine has proven of value in rigid-pavement studies. Either impact or static loads may be applied to the upright specimen to test the elastic properties of the concrete.

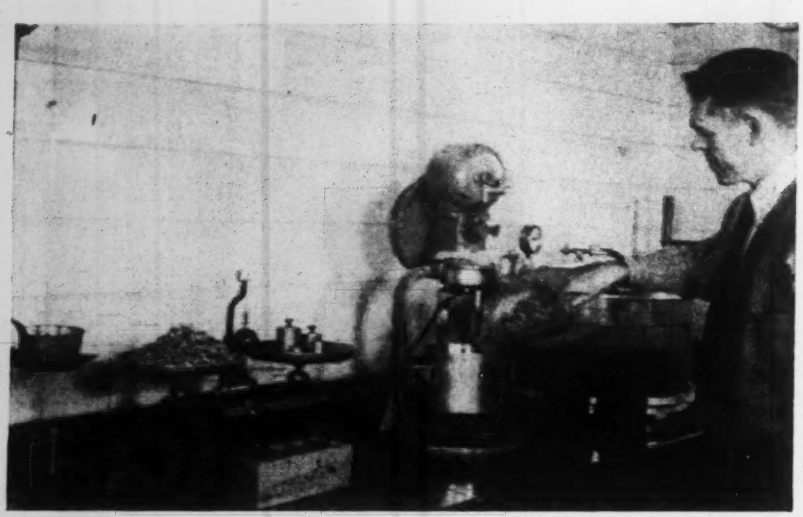
A cooperative study recently was begun with the highway departments of two eastern states on the relative value of various fillers for use in bituminous concrete. The study will include an investigation of such materials as limestone dust, trap rock dust, iron-bearing silica dust, and "fly ash," or the mineral dust precipitated from smoke by mechanical and electrical processes.

A preliminary study to determine the effect of heating and pouring operations on the properties of rubber-asphalt fillers for pavement joints has just been completed (*Public Roads*—Jan. Feb. Mar., 1947, p. 291). This study was undertaken because of unsatisfactory and variable field behavior of these materials.

Research work indicated that rubber-asphalt materials are, if properly handled, generally superior to the other joint filling and sealing materials now in use. However, the work proved that provision must be made for close control of temperatures and types of heating equipment to prevent either local or general overheating. It also showed that prolonged heating must be avoided by pouring the materials promptly, once they reach the required temperature.

Laboratory investigations of various tars are in progress to determine the effect of admixtures of petroleum products on the stability and chemical and physical properties of the resulting blends. This intensive investigation was prompted by the variable service behavior of road tars which met standard specifications but proved to have undesirable characteristics as a result either of the materials used in them or of the method of production. The investigation may result in modification of present specifications.

Work of the section dealing with



Bituminous mixtures for compression tests are made with a mixer equipped with stirring blades and bowl of an improved design that produces rapid thorough mixing. Clean discharging of the mixture from the bowl prevents contamination of following batches.

cement, aggregates and concrete is at present centered on two major problems: (1) improvement of the durability of concrete and (2) the so-called "alkali-aggregate reaction" in concrete; which produces violent internal expansion followed by ultimate disintegration, when certain combinations of materials are used.

The durability of concrete used for bridges and pavements is being improved principally by application of the principle of air entrainment. The increased use in recent years of air-entraining cement and air-entraining admixtures has appreciably increased the resistance of concrete pavements to the scaling caused by the use of salts for ice removal and to the disintegration from frost action. However, the use of air-entraining concrete has posed a number of problems for the concrete technician.

Air entrainment investigated

As part of an intensive study, PRA engineers are investigating the effect of air entrainment on the various properties of concrete. Studies are under way to determine the effect of vibration on the size and distribution of the air voids. Design of concrete mixtures to provide the desired amount of air entrainment is also being investigated.

The air-entraining studies in progress include microscopic examination of the extent, character and distribution of air voids in the concrete. In this work a microscope, fitted with a camera lucida attachment, is used to view the polished surfaces of small fragments of concrete. By means of this attachment it is possible to view the voids in the surface of the concrete and at the same time draw them to a greatly magnified scale. From the drawing or sketch it is then possible to estimate the number of voids and hence the amount of air in the concrete. Some use is also being made of thin sections of hardened concrete, in order to determine the average size of the air voids.

Another phase of the durability problem deals with the abnormal expansion which sometimes develops in concrete due to changes in temperature and moisture content. From a comprehensive series of tests for volume change—alternately immersing specimens in water at 70 deg. F. and drying them in air at 130 deg. F.—it has been found that the addition of a small amount of imported coarse aggregate to the gravels of the Platte, Arkansas, and Kaw rivers will entirely eliminate excessive expansion. This discovery is of considerable economic importance because it makes possible the utilization of these relatively inexpensive aggregates. A similar program involving materials from the Ohio River valley is now under way.

Studies of the alkali-aggregates reaction include a number of projects that hold promise of preventing the chemical reaction that has caused wide damage to exposed surfaces of concrete bridges in certain sections of the West. The laboratory is testing many hundreds of specimens involving numerous combinations of materials which may be used in future construction. Since the conventional test for identifying combinations of materials that will react chemically usually requires many months, much attention is being given to the development of accelerated tests providing the answer in days or weeks.

One mineral found to be reactive in concrete is opal. Since opal usually fluoresces under ultra-violet light, attempts are being made to utilize this principle in the study of the alkali reactivity of various types of aggregate. It is hoped that the ultra-violet light may also prove helpful in studying the durability characteristics of other aggregates.

Quick test for soft rock

A quick and simple field test which may be used for identifying "soft" fragments in aggregates has long been desired, and considerable work has been done on this problem. A simple testing tool has been made by splitting an ordinary lead pencil, removing the lead, and replacing it with a brass rod of standard hardness. Experience to date indicates that with the "pencil" it can quickly be determined whether a stone is actually soft or only appears to have this property. The pencil will scribe a soft rock but not a hard one.

A comprehensive 4-year study of blends of natural and portland cements is now nearing completion. It has been found that the virtue of such blends could be accounted for by the air-entraining properties of the natural cements. This study is described in a paper presented at the June meeting of the ASTM.

The physical properties of all types of rock in the United States are being determined in cooperation with the U. S. Geological Survey. Existing geologic maps identify the rocks encountered in different regions by kind, but no information on the physical character of each type is given. Rock samples from each geological horizon are to be submitted by the survey and the physical properties of each type determined in the PRA laboratory. It is expected that the information ob-

tained will be added to maps published by the survey, thereby greatly increasing the value of the maps to the construction industry.

To complete the description of the outstanding work of the concrete section, mention must be made of one of the investigations started a number of years ago. This study pertains to curing compounds. It has resulted in the development of an ASTM standard method of determining the efficiency of compounds proposed for use in curing concrete. The method is widely used today.

Work of soils section

To develop a more economical and faster method of surveying soils, the soils section of the research station is studying various methods of interpreting aerial photographs and combining the information obtained with that taken from geologic and pedologic maps. Work is now in progress in cooperation with the U. S. Geological Survey on a 100-square mile test area in Virginia. An engineering soil map is being prepared showing the distribution of soils and parent rocks having similar engineering properties. Also shown are drainage features, depth of overburden, location of local road-building materials such as gravel deposits, and existing and potential quarry sites. Additional sampling and testing will be necessary to establish the accuracy of the map prepared from aerial photographs and other available information.

In the development stage is a special filter press for use in preparing soil samples for plasticity, shrinkage, and other identification tests. Normally these tests are run on the fraction of the soil passing the No. 40 sieve as obtained by a dry sieving operation. It is believed that some of the active colloidal material may adhere so strongly to the coarse particles that it does not become a part of the sample tested. Under the new procedure, the soil is washed on the No. 40 sieve and all the material passing this sieve is reclaimed from the washwater by a filter press. One type of filter has already been built and research is in progress to determine the effectiveness of this method of preparation on the results in testing various types of soils.

Considerable original work is going ahead on the stabilization of natural soils by adding fine material to coarse soils and granular material to clays and other fine-grained soils. Much is also being done to determine suitable chemical admixtures for soil stabilization work and several different types of products are being investigated. At present, resinous products are being studied, but others will be evaluated.

These studies are to be carried out in a manner to assure that any process developed in the laboratory will be satisfactory in the field. As part of this work, test sections will be built in a small outdoor circular test track. Later, test sections may be built as part of an actual highway.

Special compaction machine built

A special machine for compacting soil samples for moisture-density tests has been built. It permits the standard 5½-lb. rammer to be dropped repeatedly from the standard 12-in. height with the test specimen revolved slightly after each blow to compact a new part of the sample. Not only may the height of drop of the rammer be varied, but weights other than the standards may be used.

Another new device is that designed for measuring the swelling pressure of compacted clay soils when they absorb moisture. With this apparatus the pressure that is created while a specimen is confined is measured by use of electrical strain gages.

Special equipment is also being developed to measure volume changes of fine-grained soils under repetitive loading, intrusion of one layer of material into a lower layer of a different soil as the top material is compacted, and the pumping action of soils under repetitive loading simulating moving traffic. In the latter work the specimen is placed in a 4-in. diameter cylinder and the load is applied by a piston slightly smaller than the inside diameter of the cylinder.

Rigid pavements are investigated

The structural section carries on research work having to do primarily with structural design problems—studies of the behavior of pavements and other highway structures under traffic loads. The first step, taken some years ago, was a comprehensive study of the forces to which pavements are subjected by the wheels of motor vehicles. It was found that four major variables—wheel load, vehicle speed, road roughness and tire equipment—control the magnitude of the dynamic (or impact) forces on rigid pavements.

The effect of each of the variables was thoroughly explored. The study revealed the destructive effects

Repetitive loading of a soil sample held in the 4-in. dia. cylinder is accomplished by causing the weight on the piston to be released and re-applied with each revolution of the cam.

of solid rubber truck tires on both the pavement and the vehicles, and publication of the results assisted materially in the elimination of this type of tire equipment from the highway.

Stresses due to traffic loading

Attention was next directed to the effects of these traffic loadings on highway pavements and as a result the most comprehensive investigation of the structural action of concrete highway pavements made anywhere in the world up to this time was undertaken.

For the first time it was also convincingly shown that the conventional 6-wheel (or 3-axle) truck causes no more stress in the pavement than a 4-wheel truck of the same wheel load, although the 6-wheel vehicle carries a much greater pay load. That temperature differences normally occurring within a concrete pavement slab can cause stresses as great as those which result from the heaviest legal wheel load was another pioneer discovery.

To study the structural action of concrete when subjected to dynamic loads, particularly as they affect concrete pavement slabs, a large pendulum-type impact testing machine has been built. A series of triangular-shaped concrete cantilevers simulating the unsupported corners of pavement slabs has been tested to failure under both static and dynamic forces. A report of these experiments is being prepared.

Non-rigid pavements

Attention of the structural section is now concentrated on a research of broad scope having to do with the structural action of nonrigid pavements. This comprehensive study is being undertaken in cooperation with the Highway Research Board and the Asphalt Institute.

The principal objectives of the investigation are: (1) development, by means of field bearing and moving wheel-load tests on full-size pavement sections, of fundamental data on the load supporting value of non-rigid pavement surfacings of various thicknesses in combination with various base course thicknesses and degrees of subgrade support, and (2) correlation of the field data with appropriate laboratory tests to determine whether the latter may be used alone in designing the thickness of the pavement.

Compaction of soil samples for the density-moisture tests is accomplished more uniformly with this special rig that revolves the sample slightly after each blow and permits rammers of various weights to be used and the height of drop to be varied.

As part of the non-rigid pavement studies an oval test track one-half mile in circumference, designed as an embankment 5 ft. in height, has been built of selected soil at Hybla Valley, Va., some 10 miles south of Washington, D. C. On this track, many sections of non-rigid pavement of varying designs have been constructed. The load testing of these initial sections of experimental pavement will start this summer.

In connection with the studies of the dynamics of motor vehicles, the structural section sought some device that would indicate the relative roughness of road surfaces. As a result of many experiments, a single-wheel trailer equipped with a spring deflection integrator and electrical counting system has been developed. This equipment has proven useful in studying many highway problems and "roughometers" built to this design are now being used in several states and at least one foreign country.

From time to time special problems arise in connection with highway bridge design or construction and a number of researches dealing with such problems have been conducted. For example, as one small part of the extensive research program into the aerodynamic and other characteristics of bridge structures begun after the failure of the Tacoma Narrows suspension bridge, certain studies of structural damping are currently under way in the PRA laboratory. The study deals with the internal damping characteristics of solid members as compared with trussed structural members. This particular work is directed primarily toward the solution of certain problems that arise in the aerodynamic testing of models of suspension bridges.

For a number of years the structural section also has been studying the application of electrical resistivity and seismic methods of subsurface exploration to the problems of the highway engineer. Improved portable equipment has been developed and methods of interpreting the data have been perfected. Depths to rock for foundations, location of buried rock or gravel suitable for use as a road-building material, determination of the presence of rock in proposed cuts, depth to solid layers in marshy areas or peat bogs, are a few of the determinations made by these methods. Often large savings in time and money are made possible.

Total cost of the varied activities of the research laboratory and the other research activities of the PRA is less than one percent of the total amount expended by the federal government for highways. Because of the scope and varied character of the work, large benefits are believed to result from this investment.

Supervision of the work

H. S. Fairbank, deputy commissioner of the PRA, is in charge of that agency's research department. E. F. Kelley is chief of the division of physical research and tests and is director of the research laboratory.

The four section chiefs at the station are: F. H. Jackson, who heads the cement, aggregates and concrete section; J. T. Pauls, bituminous materials and mixtures; L. W. Teller, structural design; and Harold Allen, soils section.

Varying Reservoir Levels and Discharges Forecast by New Method

N. S. Haines
Designing Engineer
The Hydro-Electric Power Commission of Ontario
Toronto, Canada

***Editor's Note**—Engineers have evolved another method for computing reservoir levels and discharges. Simplicity and speed are gained by the use of graphs, and accurate workability has been confirmed by operating results.*

HYDRAULIC STUDIES for hydro-electric or flood-control projects demand accurate estimates of fluctuating discharge from reservoirs with fixed outlets. The general effect of control, as is well known, is to minimize flood flows and to release accumulated water at reasonable and undamaging rates over a long period of time. These discharges, changing daily, then provide the basis for calculating down-stream stages in conjunction with tributary flow.

As the reservoir inflow varies constantly, such a study requires continuing determinations of the surface elevation, storage capacity, and corresponding spillway discharge. This problem involves tedious and time-consuming computations. Solution by arithmetical methods under rapid fluctuations then becomes singularly unattractive and difficult. Several procedures have been devised to simplify this problem.

Interested readers are referred to "Spillway Discharge Calculations" by L. R. East, (*Civil Engineering*, Jan. 1932) and to "Determining the Regulating Effect of a Storage Reservoir" by R. E. Horton (*ENR*, Sept. 5, 1918). The method described here is accurate and rapidly effective once the specific curves have been plotted.

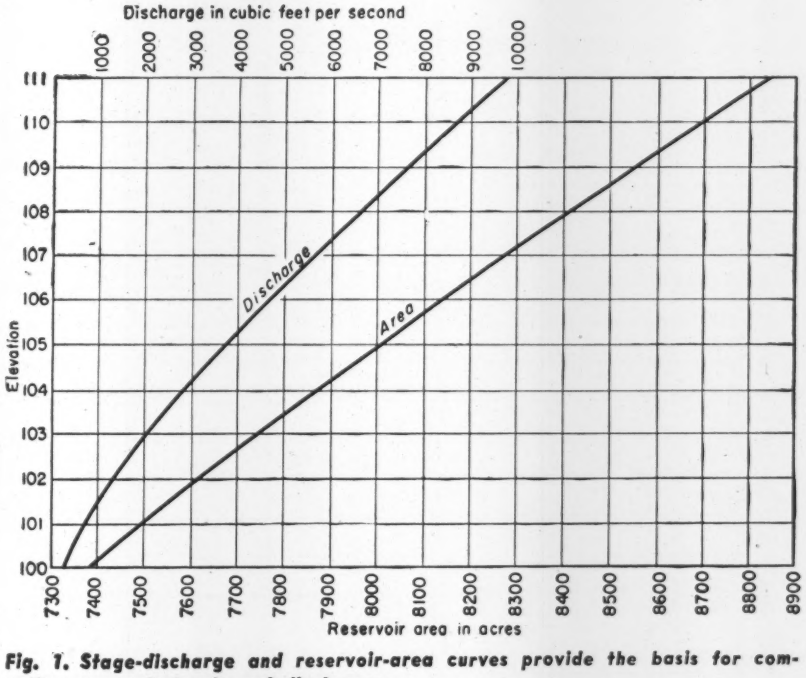


Fig. 1. Stage-discharge and reservoir-area curves provide the basis for computing reservoir levels and discharges.

Solution described

In a reservoir where supply is greater than discharge, part of the inflow will pass directly into outflow and the remainder will go to storage. The surface will rise,—the rate of rise being dependent upon the stage discharge and stage-area curves (Fig. 1). When supply is less than discharge, water is withdrawn at a rate equal to the difference between the two values. Then the water level will fall at a rate dependent upon the specific curves. That is, the water level will rise or fall until discharge equals the inflow. Moreover, the rate of rise or fall becomes slower and less pronounced as discharge approaches equalization with inflow.

Therefore, if A = the area of the reservoir in square feet at any elevation.
Q_d = the discharge from the reservoir in cubic feet per second at the same elevation.
Q_i = The inflow when the above conditions apply.
δE = a small change in elevation in feet.
δt = time required for δE to take place.

The rate of water going to storage $= Q_i - Q_d$ (may be positive or negative). $A \times \delta E =$ volume of water in cubic feet required to raise or lower water level in reservoir δE ft.

Therefore: $$t = \frac{A \times \delta E}{Q_i - Q_d}$$

Assuming δE to be 0.1 ft. and a value for Q_i within the expected range, a value for δt may be found for any elevation by substituting the corresponding values of Q_d and A in the above equation. If this calcula-

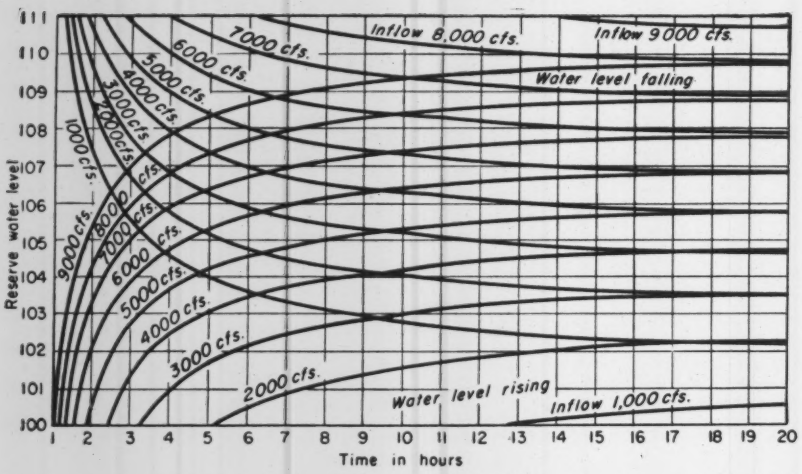


Fig. 2. For determination of the time required for water level to change 0.1 ft. the upper curves are used when the level is falling, and the lower curves when the level is rising.

tion is carried out for various flows and elevations, two families of curves as shown in Fig. 2 may be drawn by plotting δt against elevation.

The curves for any inflow are asymptotic to the elevation at which the discharge is equal to this inflow. The upper limb of the curve indicates that the water level is falling and the lower limb indicates that the level is rising. That is, δE is negative in the first case and positive in the second.

Taking the elevation at the beginning of a period of time and an inflow, the change in water level during the period may be found by arithmetic integration of the curves. These values may be plotted directly against the elevation at the beginning of the period or added to this elevation and plotted against it as in Fig. 3.

The following calculations taken from an actual study demonstrate application of the method. The change in elevation, δE, was assumed as 0.1 ft., and since the flow was measured daily, the time for arithmetic integation was taken as 24 hr.

Assuming an inflow of 5,000 cfs. and a reservoir level of El. 101.0, from Fig. 1, the outflow is found to be 780 cfs. Then,

$Q_i - Q_d = 5{,}000 - 780 = 4{,}220$ cfs. (to storage).

With the reservoir surface at El. 101.0, the water area equals 7,500 acres (Fig. 1). Then, the volume of water required to raise the elevation 0.1 ft. is

$A \times \delta E = 7{,}500 \times 0.1 = 750$ acre-ft.

Since 1 cfs. will fill 1 acre-ft. in 12 hr., 4,220 cfs. will fill 750 acre-ft. in $\frac{750}{4{,}220} \times 12 = 2.13$ hr. This calculation repeated for various elevations and flows produced Fig. 2.

The next step is to find the change in elevation in 24 hr. To start, the time is scaled off in Fig. 2 for $Q = 5{,}000$ cfs. and elevation at beginning of period 101.0. Then, at 0.1 ft. rising intervals the corresponding times are similarly found:

Reservoir elevation From	To	Time required, hours	Total time, hours	No. of 0.1ft. intervals
101.0	101.1	2.13	2.13	1
.1	.2	2.17	4.30	2
.2	.3	2.21	6.51	3
.3	.4	2.25	8.76	4
.4	.5	2.29	11.05	5
.5	.6	2.33	13.38	6
.6	.7	2.37	15.75	7
.7	.8	2.41	18.16	8
.8	.9	2.46	20.62	9
.9	102.0	2.50	23.12	10
102.0	.1	2.53		

Therefore rise in 24 hr. = 0.1

$$\left(10 + \frac{24.00 - 23.12}{2.53}\right) = 1.03 \text{ ft.}$$

That is, with an inflow of 5,000 cfs. and a water elevation at the beginning of a 24-hr. period of 101.0, the elevation at the end of the period will be 102.03. This calculation repeated for various flows and elevations provided the bases for Fig. 3.

Furthermore, the work was checked by measuring levels from actual inflows and checking against computed elevations. The error at the end of a three-week period was less than 0.15 ft.

Then Fig. 3 was used to study a large number of proposed inflow regimes and their effect on reservoir levels and stream flows.

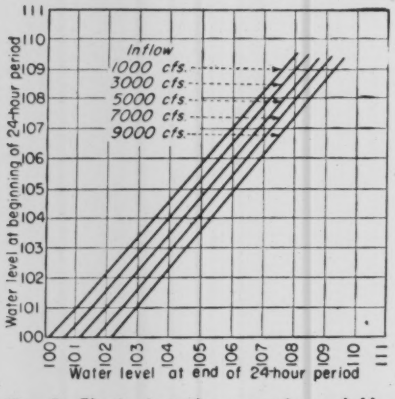


Fig. 3. Final elevation may be quickly found when the initial elevation and 24-hr. inflow are known.

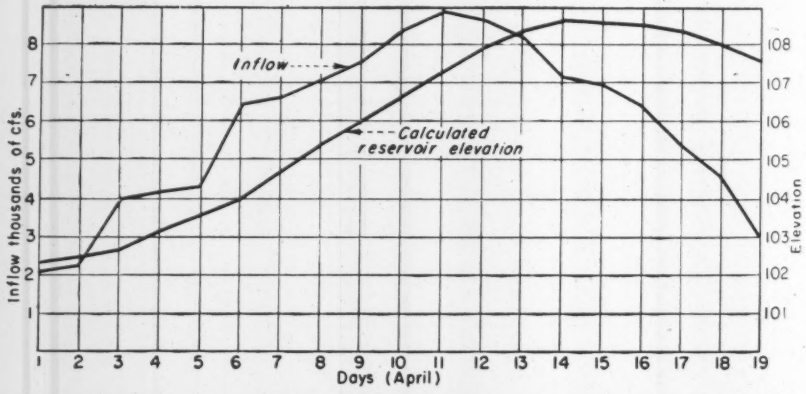


Fig. 4. A graphic picture of the dynamic condition of the reservoir over a period of time results when inflow and calculated reservoir elevation are plotted against days on the equivalent coordinates.

Date	Inflow cfs.	Calculated Reservoir Levels	Date	Inflow cfs.	Calculated Reservoir Levels
April 1::	2,100	102.33 (known level)	April 11::	8,988	107.37
2::	2,200	102.48	12::	8,758	107.99
3::	4,000	102.63	13::	8,234	108.42
4::	4,150	103.41	14::	7,172	108.70
5::	4,300	103.57	15::	7,009	108.67
6::	6,559	103.96	16::	6,454	108.60
7::	6,680	104.79	17::	5,378	108.44
8::	7,149	105.42	18::	4,598	109.09
9::	7,646	106.09	19::	2,892	107.65
10::	8,480	106.70			

The above inflows are from a flood hydrograph for the reservoir and the elevations from Fig. 3. From these data, the inflow and calculated reservoir elevation then may be plotted daily to give a graph as shown in Fig. 4.

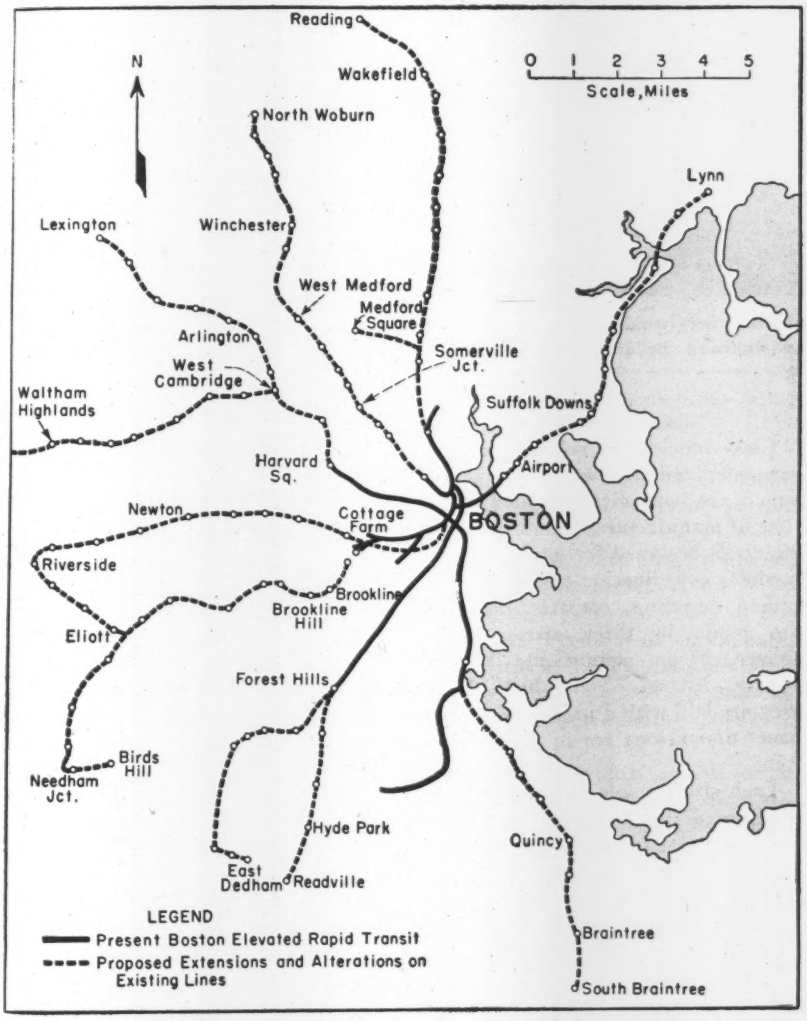
If the elevation at the beginning is unknown, an elevation approximately two weeks previous should be estimated as close as possible and used as a starting point. Any error in estimating will then have little effect on the elevations at the critical period.

This method was devised as a result of studies made by the writer.

New Plans for Boston Rapid Transit

A special legislative commission of the Massachusetts State Legislature recently completed a 4-year study by recommending a $100,000,000 plan (based on today's costs) to give fast electric train service to some 29 suburban communities.

Under the plan, the Boston Elevated rapid transit lines would be extended in great part over existing railroad rights of way to provide fast commuter service in electrified equipment that would replace present heavy equipment of steam-drawn trains.



Proposed extensions of the Boston rapid-transit system as surface lines to serve suburban towns lacking fast commuting service.

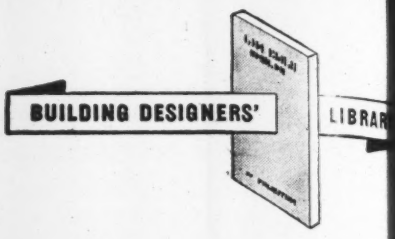
Among recommendations of the commission are the removal of the present elevated structure to Forest Hills, and between North Station and Sullivan Square, Charlestown. Also recommended is extension of the Braintree line to South Braintree, extension of the Dedham line to East Dedham and construction of a second branch from Forest Hills to Readville; continuing the Needham line to Bird's Hill; extending the Arlington line to Lexington; and the Woburn line to North Woburn.

The commission also recommended that the existing Park Street and Boylston Street subway stations be combined into one 2,800-ft. station like Chicago's Loop station.

The report said that the Commonwealth of Massachusetts should take over for rapid transit routes the railroads' rights-of-way to the city at a "very reasonable rental cost based on their salvage value." Railroad engineers, citing their company's losses in late years on commuter business, are reported favorable.

At most points along the proposed route, it is suggested that the present railroad stations be used.

A secondary result of such extended transit systems, the commission added, would be a partial solution of the city's growing traffic problem by making it possible for workers living in suburban towns to reach the city easily without resorting to their automobiles.



How To Select and Install GLASS BLOCK

K. H. Cunningham

Architectural Engineer, Insulux Products Division, Owens-Illinois Glass Co., Toledo, Ohio

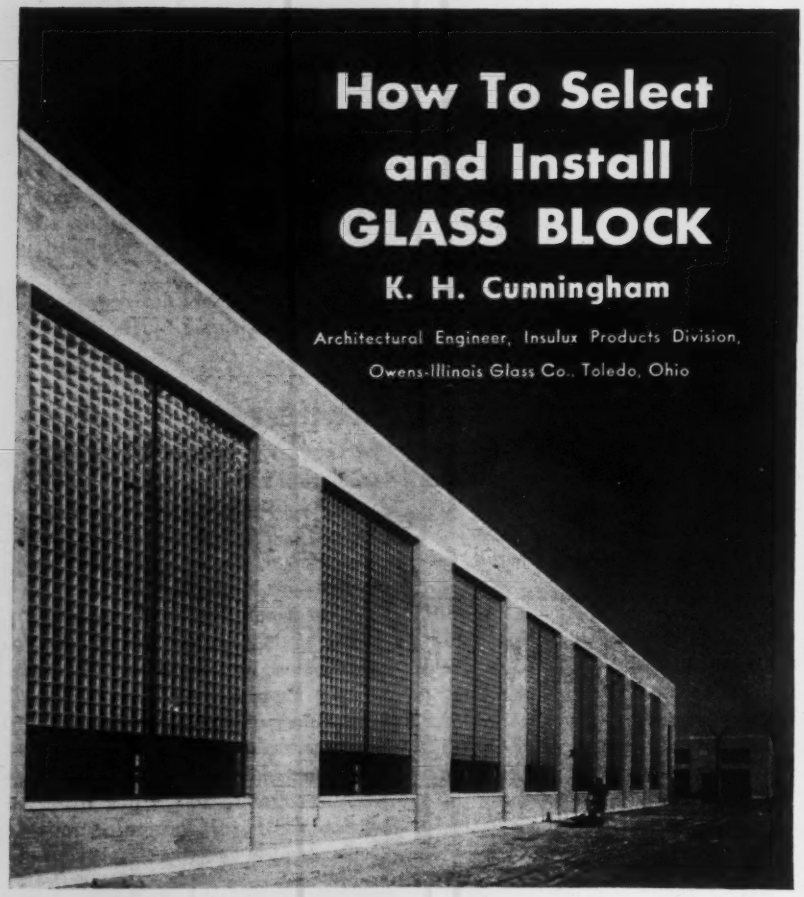


Fig. 1. Glass-block panels are used in combination with windows to provide much well diffused daylight in the Rock Island Railroad building at Chicago, Ill.

***Editor's Note**—Useful data on glass block were given in another article in this series, "Lighting Principles and Practice With Glass Block Panels," by D. A. Bridges (ENR, July 3, 1941, vol. p. 29). The following amplifies that discussion.*

IF GLASS BLOCK is to be used to its greatest advantage in the design of a building, a knowledge of its characteristics is necessary, because it is more than just a decorative material. It performs a twofold function. It serves where the insulating qualities and durability of masonry are required and passage of light is desired.

The principal uses of glass block are in panels alone or in combination with windows for daylighting buildings, for replacement of worn-out windows in existing structures, for light-transmitting interior partitions and for various decorative uses.

Glass blocks are hollow, partially evacuated units of water-clear glass, which are hermetically sealed at the time of manufacture. One of the first materials designed for use in the new modular coordination system for simplified building construction, they are made in three sizes—5¾ in. square, 7¾ in. square and 11¾ in. square. All are 3⅞ in. thick. Since they are laid with ¼ in. mortar joints, panel dimensions are in multiples of 2 in.

Each size is made in a wide variety of face designs, which determines the light-transmitting characteristics. These face designs fall into three general classifications—functional, decorative and general purpose. The functional types are designed to direct and diffuse daylight and are especially recommended for use on sun exposures. Designs classed as general purpose have high light-transmitting characteristics but do not have the light-controlling properties for use on severe sun exposures that are characteristic of the functional types. Decorative designs are intended for use wherever appearance and sparkle, rather than light control, is desired.

Block controls lighting

In recent years, substantial progress has been made in the development of the light-transmitting characteristics of glass block. Units are now available that can control light to the extent that shading devices are not required even on direct sun exposure. The design shown in Fig. 2 is of the type that directs light upward.

The advantage of such a unit are illustrated in Fig. 2. As shown at the left, when light enters a room through an ordinary piece of glass, too much light is available near the outside wall and too little farther back in the room. Good visibility is made difficult by the uneven illumination and high brightness contrasts. Although shades may be used to reduce the amount of light entering the room, contrasts remain high and the light level may be too low for satisfactory working conditions.

At the right in Fig. 2, the upper part of the opening is filled with prismatic block that directs the light to the ceiling, which in turn reflects it onto the working surface. Because the major portion of the light is above eye level, the panel when viewed from below has a low brightness, regardless of the intensity or angle of the sun. The result is more even distribution of light to all points of the room, together with lower brightness contrasts.

Because the block shown in Fig. 2 directs light upward, it cannot be used below eye level. However, other types of glass block such as the one with light-directing properties used in the lower part of the opening in Fig. 2 are available for use in the lower part of panels. In certain types of buildings, such as offices, where natural vision and ventilation are necessary, continuous windows below

the prismatic block transom may be used (Fig. 1).

To take full advantage of light-directing block, it is necessary to observe certain basic rules in the design of rooms to be daylighted. For example, ceilings must have high light reflectivity. Glass areas must be adequate and the head of the panel should be as high above the floor as possible.

Heat and sound insulation values

When compared to most light-transmitting materials, the insulating value of glass block is high. Its heat loss in winter is as low as a plastered 8-in. brick wall. Tests conducted by the Pittsburgh Testing Laboratories, Pittsburgh, Pa., assign a U-value for a 15-mile wind of 0.49 for smooth-face block and 0.46 for ribbed-face block. Due to the low conductivity, condensation will not form on glass-block panels until much lower exterior temperatures are reached than required to produce condensation on single glazing. For example, with an inside temperature of 70 deg. and a relative humidity of 40 percent, condensation will not appear on the panel surface until the outside temperature drops to —14. Under similar conditions, condensation will form on a single sheet of glass at +33.

Tests recently made show also that standard smooth-face glass block, laid up in panels, transmit but 40 percent of the solar heat passed by a single-glazed window. Light-directing block transmits even less solar heat than the standard type.

Sound transmission tests on glass-block panels show an average sound reduction of 40.7 decibels over a range of nine frequencies. This compares favorably with various partition materials, such as 4-in. clay tile plastered on both sides.

Tested by the Underwriters Laboratories, Inc., 6-in. and 8-in. glass block have been approved as a fire retardant for Class F openings. Special construction details are required for fire retardant panels, which are limited to 120 sq.ft. in area.

Panel installations

Most building codes limit the size of panels to 144 sq.ft. without intermediate support. If panels of greater size are desired, intermediate vertical mullions or horizontal shelf angles of structural steel or concrete may be used.

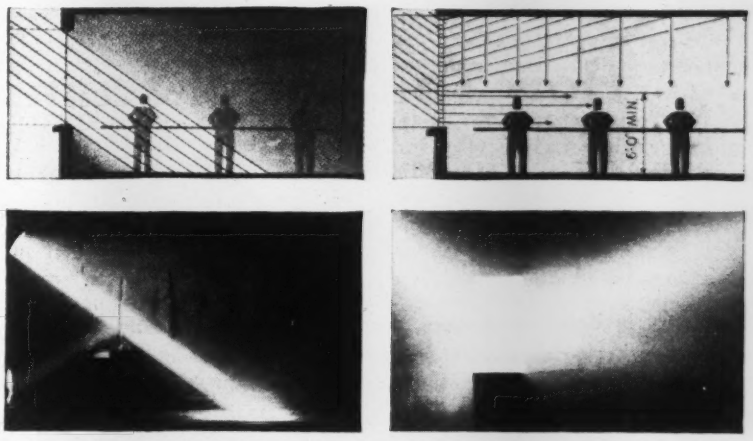


Fig. 2. Light transmitted through an ordinary pane of glass (left) is too intense near the window and not bright enough farther away. Use of light-directing glass block (right) results in more even distribution.

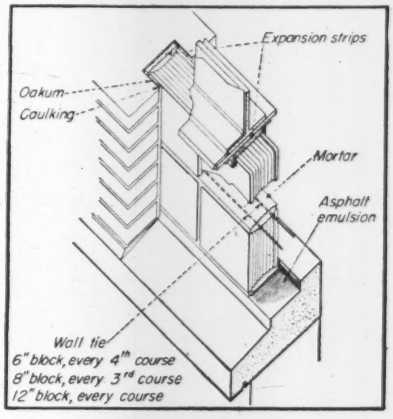


Fig. 3. Essential elements in the installation of glass block panels.

All panels must be supported around their perimeter by the building structure. A good method of providing this support is to set the edges of the panel at the top and sides into a chase or rebate formed by masonry, concrete or surrounding structural steel shapes.

Used in individual panels or in continuous horizontal or vertical ribbons, glass block is not load-bearing and requires a framed opening similar to that used for windows and doors. It must be protected from direct contact with the building at both jambs and heads of panels. Usually, a resilient expansion strip made of fibrous glass material bonded into a board $\frac{3}{8}$ in. thick, $4\frac{1}{4}$ in. wide and 25 in. long is applied at the jambs and heads of the opening before the installation of the block.

To provide good bond and to facilitate laying, the edges of the glass block are corrugated and coated with a grit-bearing material. The blocks are laid by masons with standard tools and masonry mortars. The mortar recommended is a rather dry mix consisting of one part waterproof portland cement, one part high-calcium hydrated lime or well-slacked quick lime and four parts of well-graded sand.

Care should be taken to obtain full head and bed joints. Horizontal mortar joints should be reinforced at regular intervals by welded wire wall ties. Panels of 6-in. block should be reinforced every fourth horizontal joint, panels of 8-in. block every third horizontal joint and panels of 12-in. block every horizontal joint (Fig. 3).

Setting glass block

Before glass block is laid, a $\frac{1}{32}$-in. thick asphalt-emulsion coating should be applied to the sill. After the block has been set in place, the surface of the mortar joint should be tooled to a smooth finish, and when the mortar has reached its initial set, the panel should be given a preliminary cleaning. After the mortar has set, the expansion joints at jambs and head should be calked by ramming okum into the spaces between the sides of the block and the sides of the chase or rebate and by pointing the surfaces of these joints with a non-hardening calking compound.

How To Control Scum in Digesters

Frank L. Flood
Consulting Engineer, Metcalf & Eddy
Boston, Mass.

***Contents in Brief**—Makeshift measures taken to eliminate floating scum blankets in sludge digestion tanks have resulted occasionally in destructive explosions. Affording safety and convenience a built-in recirculation system using warm clear liquor forcefully discharged over the scum blanket has been provided to alleviate floating layers. Consisting of selective suction connections to the clear liquor zone, a centrifugal pump, and four equally-spaced outlet nozzles set a few inches above the liquid level, this scheme enables the operator to wet and disperse scum at any time by starting the pump and adjusting valves in the control house.*

FORMATION of excessive depths of floating scum in sludge digestion tanks has been the cause of considerable concern and, sometimes, of grief to sewage plant operators. Occasionally tanks have been destroyed and adjacent structures damaged by explosions set off during make-shift measures taken to eliminate scum blankets.

What can be done to solve this serious problem?

In the separate digestion process, sludge from sedimentation tanks is discharged to storage tanks. It is retained there for periods varying from twenty days to several months. Heat, customarily applied to these tanks, promotes digestion. The most effective temperature range varies from 80 to 100 deg. F.

The tanks are usually insulated and topped by fixed roofs or floating

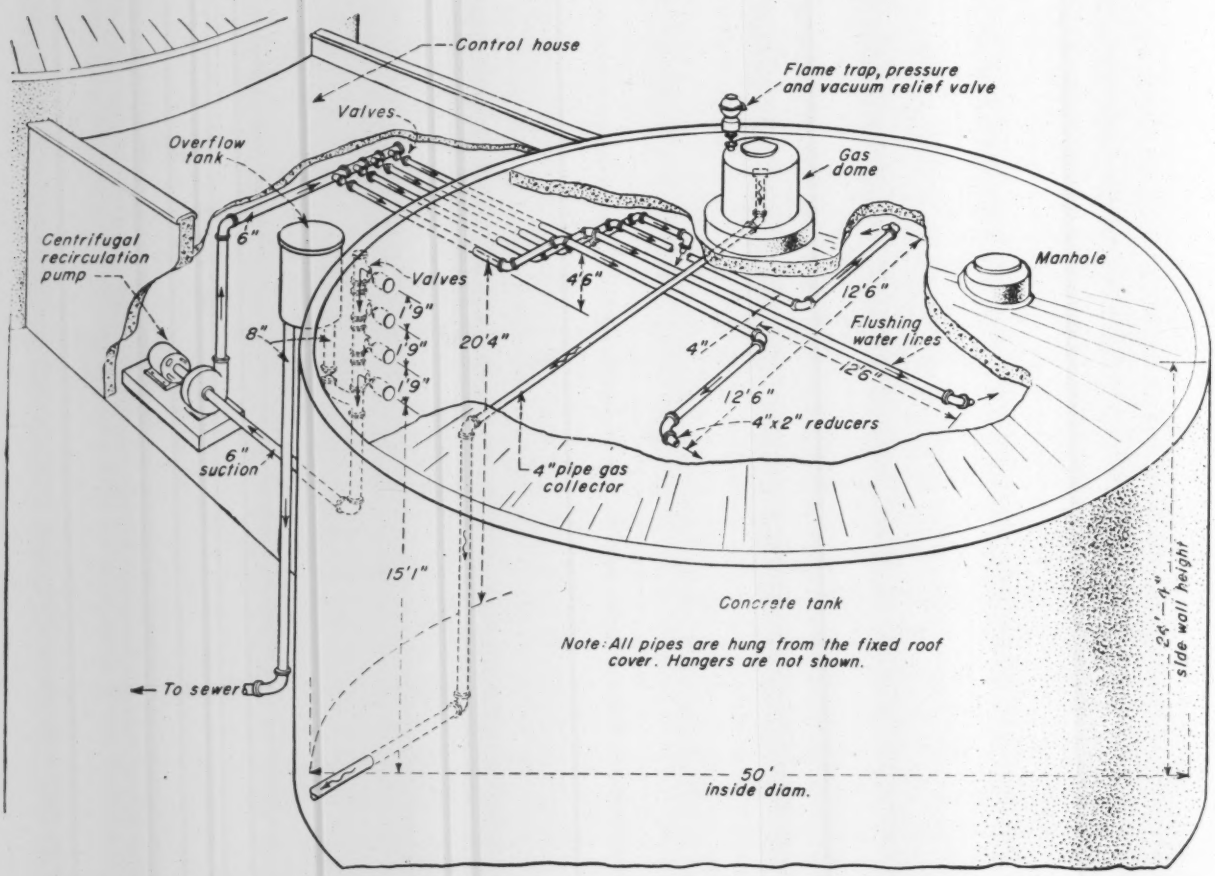


Fig. 1. Piping and pump installation to facilitate the control of scum formation in a sludge digestion tank. With such an arrangement it is possible to provide wetting, heating and agitation.

covers that minimize heat losses and permit gas collection.

Floating solids, if neglected, may gather above the liquid to a thickness nearly equal to one-half the sidewall depth. This scum collects in a relatively solid, inert mass. Such accumulations reduce effective tank capacity, obstruct escape of gas to the dome, clog overflow lines, and interfere with operation of heating coils.

Scum destruction by means of a hose stream and removal through roof manholes are inconvenient operating expedients. These methods do not prevent recurrence of scum formation and openly invite disaster through creation of explosive gas mixtures.

To preclude development of objectionable floating layers, scum particles must be kept moist and thin, maintained at optimum alkalinity and temperature, and saturated constantly with digesting organisms.

Various types of mechanical equipment—paddles, propellers, agitators and mixers—are used to combat scum collection. Some operating difficulties have occurred with such mechanisms. Maintenance and repair work inside digestion tanks is difficult, involves shutdowns, and subjects skilled workmen to hazardous conditions. To insure safety, tanks must be completely emptied, or partially drawn down and purged of all gas during the work.

System described

A scheme to satisfy requirements for minimum scum formation—wetting, heating and agitation—is shown in Fig. 1. This piping and pump installation enables the operator to withdraw warm liquor from the "clear liquor" zone and to discharge it through nozzles onto floating layers.

These nozzles set at 45 deg. angles terminate a few inches above the liquid surface. Four nozzles spaced at equal angles and located at midpoints of radii discharge tangentially downward. This action induces circulation in the scum zone, mixing of scum and supernatant liquid and encourages escape of gas into the collection dome. Moreover, temperature of scum is raised by contact with warmer liquid.

Warm liquor may be directed consecutively through each nozzle at high pressure and large volume, or simultaneously through the four nozzles at lower head and quantity per outlet. This flexibility permits the operator to determine the most effective operational procedure.

With four nozzles placed as shown in Fig. 1, scum treatment may be applied conveniently and safely at any time merely by starting the circulation pump and adjusting proper valves in the control house.

Digestion tanks may be heated by an extension of this scheme. Liquor from the clear zone is passed through heat exchangers before it is returned to the tank.

The flushing system may be used also for distribution of raw sludge to the digestion tank. In this case raw sewage must have been comminuted or sludge must be pumped by units which cut up large objects.

Continuous recirculation probably will not be necessary for effective control of the scum blanket. Operation for one hour each day should be ample.

By means of periodic sampling and occasional observation through the roof manhole, the operator can determine the nature and extent of scum accumulation. Then the flushing system may be used as necessary to keep scum under control.

Atmospheric Contamination Demands Research and Field Study

Industry and public agencies must cooperate in seeking a more fundamental engineering basis to free the atmosphere of industrial centers from excessive pollution, W. C. L. Hemeon, head engineer of the Industrial Hygiene Foundation of American, Mellon Institute, Pittsburgh, declared before a symposium on industrial waste at a recent meeting of the American Chemical Society.

Increasing community demands for clean atmospheres will necessitate further research and field study concerning the collection of dusts and fumes.

Also basic information on stack gas cleaning equipment and other control measures, especially for the small plant, is vitally needed.

"Pollution of the community atmosphere by air- or gas-borne contaminants to some degree is an integral part of the industrial scene, and will never be entirely eliminated," Mr. Hemeon said. "One common extreme view ignores the practical facts and demands the purity of country air in our cities.

"At the other extreme is the attitude of smugness which associates atmospheric pollution with industrial prosperity, ignoring the desirability of its reduction by technical measures of proved practicability. For the most part, however, there is agreement on the desirability of minimizing emission of pollutants, disagreement developing only as to the practicality of control in specific circumstances."

Only one contaminant, sulfur dioxide, has a scientific assessment of the point at which concentrations become offensive, Mr. Hemeon explained.

"There is clearly a need for additional research for the development of standards for other common air pollutants," he said. "Substances like sulfur dioxide that may do specific damage to plant or animal life, or to structural materials, lend themselves neatly to relatively exact treatment in the development of standards of permissibility. On the other hand, these pollutants that are primarily offensive to people require entirely different research techniques for the development of realistic standards."

Reasonable standards needed

Practical standards must give due weight to the factors of tradition of the community, its socio-economic status and history of the industries. For example, one would not expect the same standard for a city of heavy industry as for a New England town accustomed to the operation of light industry.

Moreover in the absence of established facts from which to derive standards, it is perfectly proper to adopt values which represent simply a reasonable compromise between the ideal cleanliness of country air and the high degree of pollution to which some of our cities are now exposed."

Fig. 1. The scaling surface of Tugalo Dam was repaired by cleaning, then adding 2½ in. of air-applied mortar

Sliding Scaffold Speeds Repair of Dam

***Contents in Brief**—A sled-runner scaffold and a crew in balanced units for each of the several operations necessary made possible rapid and economical resurfacing of the downstream face of Tugalo Dam in Georgia.*

USE of a movable scaffold, with sled runners, and a streamlined work program, speeded the work and lowered the total cost of resurfacing the Tugalo Dam of the Georgia Power Co. The 155-ft. gravity concrete dam near Tallulah Falls is one of six of the company's hydro-electric dams in north Georgia. It is 850 ft. long at the top, 300 ft. at river level, and about 115 ft. thick at its base.

Since completion of Tugalo in 1923, no repairs had been made on the dam. However, in recent years small cracks and spalling had appeared on the downstream face of the dam, resulting in surface erosion that became unsightly. The condition resulted from small surface cracks filling with moisture with consequent alternate freezing and thawing during extreme cold weather.

A study of the problem of resurfacing by the engineering and operating departments of Georgia Power Co. led to the conclusion that repairs and resurfacing could best be accomplished by an air-applied mortar surfacing put on from a sliding scaffold.

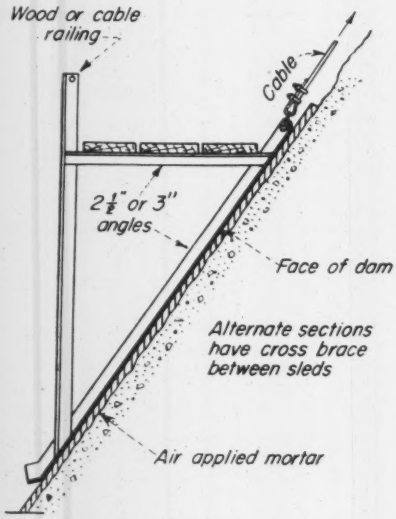


Fig. 2. Sled-runner frame made of scrap angles supported the work scaffold.

The other method of repair considered was to pour a slab on the surface of the dam. However, that would have required extensive forms and scaffolding, with their repeated moving. Also a substantial amount of auxiliary and concrete mixing equipment would have been required for the process.

Small amount of equipment

Equipment necessary for the surfacing work consisted of a portable electric-driven 500-cfm. air compressor used to operate four chipping hammers, and the mortar gun; a dry mixer, a water-supply pump and the scaffolding.

So that work could be continuous and scaffold elevation changes made without work interruptions, the dam was divided into six sections—the intake 220 ft. long; three spillway units of 125 ft.; and abutments of 90 and 120 ft.

Frames or sleds for the movable scaffold were made in the company's shop of 2½ and 3-in. scrap angle iron and assembled at the base of the dam. The sleds were held or draw up the face of the dam by steel cables an-

chored at the top. The sleds were placed 18 ft. apart to support a 3-plank scaffold. The catwalk was hinged at each of the dam sections so that one or more units could be raised to the next higher level as work progressed.

An 18-man crew was used, consisting of four chippers, one operator for the sand and cement mixing machine; three men to feed the mixing machine, four men in the resurfacing crew, one application gun operator, one hand finisher, one man to wash down the dam after chipping, and three laborers.

Old surface chipped off

Chipping was started a few days in advance of the other work. About 1½ in. of old concrete was removed to reach sound material and the surface was left rough to insure good bonding. Over the chipped surface was laid a 6x6-in. No. 6-gage 72-in. wire mesh, which was held in place by a ¾-in. x 4-in. expansion anchor bolt. Mesh was held 1¼-in. out from the surface.

Holes for the anchor bolts were drilled with air and star drills after the mesh was placed on the surface of the dam. The holes were spaced on 3-ft. centers, with alternate rows staggered.

After anchoring the mesh, the surface was washed down with water to remove all loose material and dust. A 2½-in. covering of air-applied mortar raised the surface 1 in. above the original face of the dam. The dry mix consisted of one part cement and three parts sand. Air at 55 psi. carried it to the mixing nozzle where it was combined with water at 60 psi. to form the mortar. The surface was finished smooth by trowel or wood float, and kept wet for eight days by water from perforated pipes.

Work started at the base of the dam by chipping a 6-ft. vertical area along the length of one section before raising part of the scaffold to the next higher level. Each crew was organized to average about a 40-ft. section each working day with the chippers moving to the next higher level before the other units completed their work. This method made for continuous progress without work interruptions.

Cost of the work was about 50 percent less per square foot than for similar repairs done by contract in 1941-1942, when labor and materials were cheaper. A great portion of the cost on the previous dam resurfacing job was constructing a scaffold over the entire working surface and then rebuilding it over the next area as work progressed. The Georgia Power Co. eliminated this extra cost by use of the movable scaffold, which permitted greater efficiency and speed in the work.

The work was done by the owner's forces under supervision of Wes Edmonds, assistant superintendent of North Georgia plants.

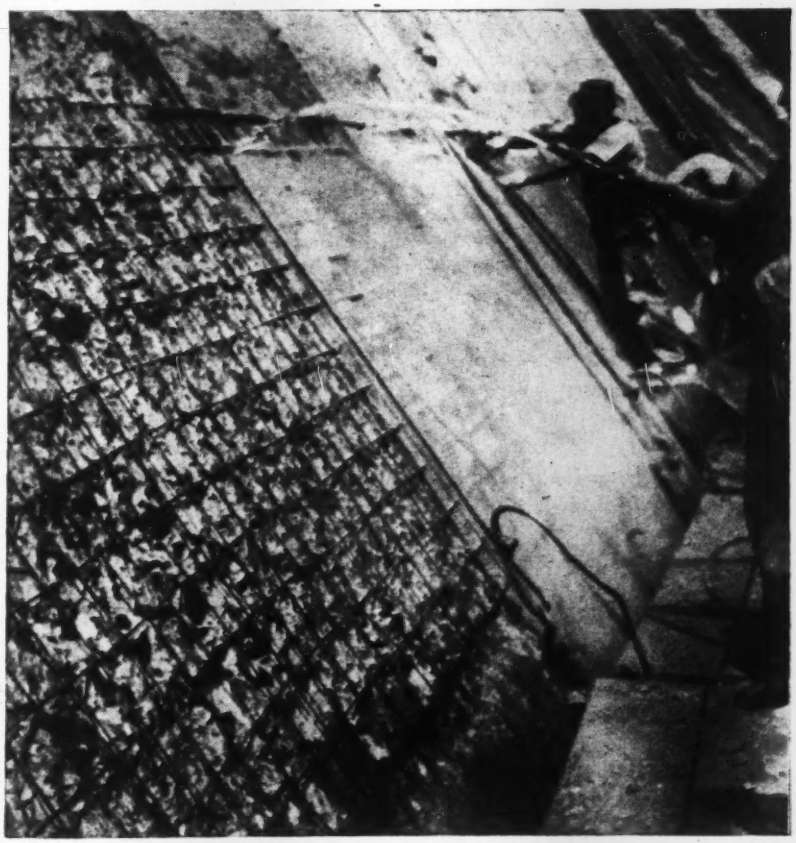


Fig. 3. The scaled surface was chipped to 1½ in. below the original face, mesh was fastened with expansion bolts, then the old concrete was washed and kept wet prior to resurfacing as an aid in bonding the 2½-in. cover of air-applied mortar.

Illinois Lab. Methods Adopted in Standards

Three analytical methods for the examination of water and sewage, developed in the laboratory of the Illinois state water survey, are included in the ninth edition of "Standard Methods for the Examination of Water and Sewage," published recently by the American Public Health Association, New York.

These standard methods edited by a joint committee of the American Public Health Association and the American Water Works Association are recognized as authoritative by courts of law as well as federal, state and municipal health authorities.

One of the new methods developed by the water survey is for the determination of the amount of methane (marsh gas or fire damp) which is sometimes found in well water. The survey reports several serious explosions have occurred in various towns due to the fact that the presence of this inflammable and explosive gas was not recognized.

The second method is designed to determine the amount of hardness in water. It is more rapid and accurate than previous methods.

The third method was developed to control the treatment of waste waters from various manufacturing processes.

Will Your Reservoir Refill During Minimum Demand Periods?

R. L. Brown
Assistant Engineer
Black & Veatch, Consulting Engineers
Kansas City, Missouri

***Contents in Brief**—Studies of water distribution systems often involve determination of time required to fill a reservoir. This calculation should be made to check the size of the supply main. If this pipe is too small, the reservoir cannot be refilled to a safe operating level during the period of minimum outflow. Formulas for two variations of this problem—one with constant supply pressure, and the other with varying input head—are derived in this article.*

HYDRODYNAMIC investigation of an existing or proposed reservoir situated some distance from a pumping station is frequently encountered in water supply studies. It is often required to determine if the impounding structure will refill to a safe operating level during the off-peak period.

With a known pressure at the pumping station, flow to the reservoir can be obtained for a given water level by use of the Hazen-Williams formula. As the reservoir fills, the water level changes constantly. The fill-up time, therefore, cannot be found readily by simple arithmetic. However, use of calculus will provide a precise answer.

Briefly, the problem may be stated as follows: A pump supplies a reservoir with water through a pipe line. Constant pressure is maintained at the pump. How long will it take to fill the reservoir; or at what height h will the water in the reservoir be at the time t? As a basis the Hazen-Williams formula, $H = KQ^{1.85}$ (1), where H = the head loss, (ft.), K = a constant depending on length, size, and condition of the pipe line; and Q = rate of flow, (cfs.), will be used.

Then, under the assumptions, (a) the reservoir has vertical side walls, and (b) A is the area of the reservoir (sq.ft.), and (c) h is the rise in water level (ft.), the differential, $\frac{Q}{A}\,dt = dh$ (2), can be written (Fig. 1). To show that this equation is dimensionally correct, the terms may be expressed in units, and

$$\frac{\text{cu. ft.}}{\text{sec.}} \times \frac{1}{\text{sq. ft.}} \times \frac{\text{sec.}}{1} = \text{ft.}$$

Further, by rewriting (1), $Q = \left(\frac{K}{H}\right)^{\frac{1}{1.85}} = \left(\frac{H}{K}\right)^{0.54}$ (3).

From Fig. 1, $H = B\text{-}h$. Substituting this value of H in (3),

$$Q = \frac{(B-h)^{0.54}}{K^{0.54}} \quad (4).$$

If the value of Q in (4) replaces Q in (2),

$$\frac{(B-h)^{0.54}}{K^{0.54}} \times \frac{1}{A}\,dt = dh \quad (5).$$

Separating the variables, equation (5) becomes $dt = A\,K^{0.54}\,\frac{dh}{(B-h)^{0.54}}$ (6).

Integrating (6),

$$t = -2.17\,A\,K^{0.54}\,(B-h)^{0.46} + C \quad (7)$$

where C is a constant of integration.

Introducing the condition, when $t = 0$, $h = 0$, $C = 2.17\,A\,K^{0.54}\,B^{0.46}$.

Substituting this value for C in (7), the final equation becomes

$$t = 2.17\,A\,K^{0.54}\,[B^{0.46} - (B-h)^{0.46}] \quad (8).$$

Some assumptions may be necessary in an actual problem. If the main serves consumers during the filling period, this demand must be negligible as compared with the flow to reservoir. Since the off-peak period is considered in this analysis, this derivation is accurate.

If the distributing reservoir receives its supply from a higher storage basin where a constant water level is maintained, the solution is identical.

Problem with varying head

When the water level is not constant in the higher reservoir and no water is added from an outside source to either reservoir, the time required to fill the lower reservoir can be de-

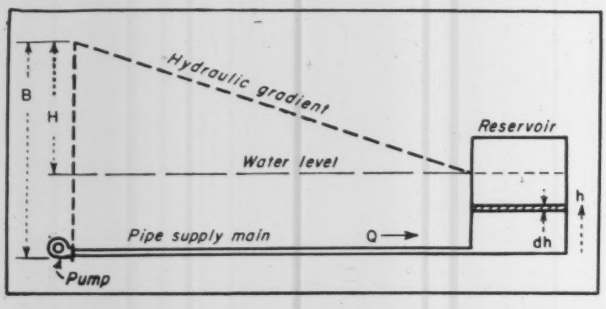


Fig. 1. First, supply under constant head is considered.

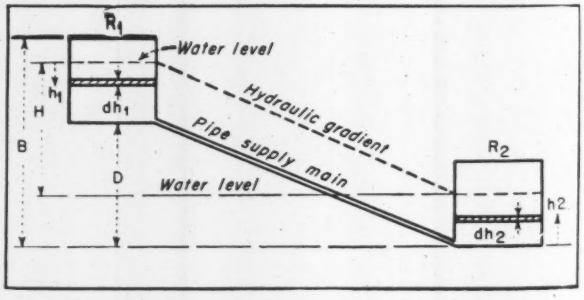


Fig. 2. Then, inflow under varying head is analyzed.

termined by a similar process. This problem may be stated as follows:

One reservoir, R_1, (Fig. 2) supplies water to another, R_2, by gravity through a pipe line. No water is taken away or added to either reservoir from an outside source. What will be the heights (h_1 and h_2) of the water in the two reservoirs in time t?

As in the previous solution, the Hazen-Williams formula,

$H = KQ^{1.85}$ (1) is used.

From Fig. 2, $D + h_1 - h_2 = H$ (9).

Taking the derivative of (9) with regard to the direction of motion, gives

$dh_1 + dh_2 = -dH$ (10).

Also from Fig. 2, $dh_1 = \frac{Q}{A_1} dt$ (11) and

$dh_2 = \frac{Q}{A_2} dt$ (12).

Substituting the value of dh_1 in (11) and of dh_2 in (12) into equation

(10), $\left(\frac{Q}{A_1} + \frac{Q}{A_2}\right) dt = -dH$ (13).

By algebra (13) becomes $\frac{A_1 + A_2}{A_1 A_2} Q dt = -dH$ (14).

Rewriting (1), $Q = \frac{H^{0.54}}{K^{0.54}}$ (15).

Substituting the value for Q in (15) for Q in (14),

$$\frac{A_1 + A_2}{A_1 A_2} \frac{H^{0.54}}{K^{0.54}} dt = -dH \text{ (16)}.$$

Separating the variables in (16),

$$dt = -\frac{A_1 A_2}{A_1 + A_2} K^{0.54} \frac{dH}{H^{0.54}} \text{ (17)}$$

Integrating (17),

$$t = -2.17 \frac{A_1 A_2}{A_1 + A_2} K^{0.54} H^{0.46} + C \text{ (18)}$$

in which C is a constant of integration.

Assuming reservoir R_1 full, and R_2 empty when $t = 0$, then from Fig. 2 $H = B$ when $t = 0$,

$$C = 2.17 \frac{A_1 A_2}{A_1 + A_2} K^{0.54} B^{0.46} \text{ (19)}.$$

Substituting the value of C in (19) for C in (18), the completed equation is

$$t = 2.17 \frac{A_1 A_2}{A_1 + A_2} K^{0.54} (B^{0.46} - H^{0.46}) \text{ (20)}$$

Since the areas of the two reservoirs are known, heights h_1 and h_2 in time t can be determined by arithmetic from the value of H obtained in equation (20).

of value to other designers. The additional cost of this special construction is offset by the increased flexibility of the sales space.

Wide floor space provided

This sales building, which is part of a Sears-Roebuck postwar expansion program, is typical of many department store buildings where extensive storage facilities are not required. It is 120 ft. wide and 236 ft. long. Columns are spaced 24 ft. from each wall across the width of the building. The girders are spliced 11 ft. inside of each column, making girder lengths of 35, 50 and 35 ft. Girder spacing is 26 ft. center to center, except for a spacing of 28 ft. in the middle of the building. Thus with six suspended girders, the columnless area is 184x72 ft.

The girders support only the second floor. The roof is not dependent on the long-span girders for support as the steel roof trusses span the 120 ft. between outside columns.

The accompanying sketch shows how the 36-in., wide flange beams are spliced. The suspended beam is on the right. Location of the splice was determined by the position of zero moment under uniform loading conditions.

Involved on the design and construction of this building are Rowland H. Crawford, architect; S. B. Barnes, structural engineer; and Griffith Company, general contractor.

Suspension Beam with Unique Hinge Provides Wide Unobstructed Floor

A clear span of 72 ft. is provided in the first floor sales room of a Santa Monica, Calif., store by a type of girder construction used occasionally in bridge construction but rarely in building design. Although this span is not a record for such work, the girder hinge detail, which results in a 50-ft. suspended beam, may be

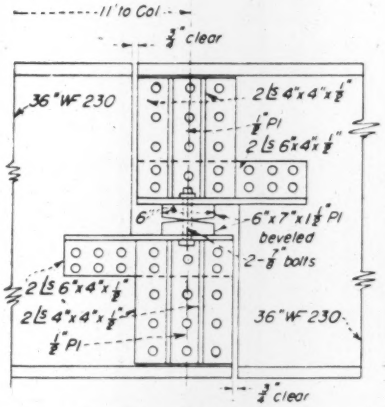


Fig. 1. The hinge detail shown here is typical of bridge work, but is used infrequently in building design.

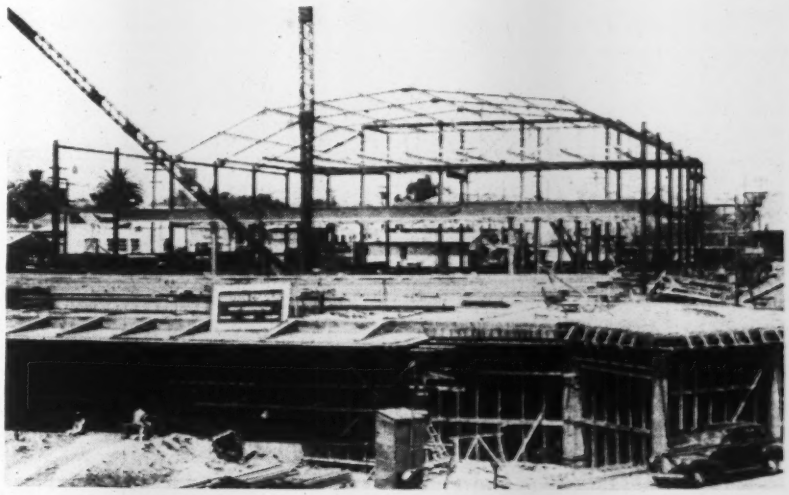


Fig. 2. Girders supporting the second floor of this Santa Monica, Calif., store building are so spliced that a 72-ft. clear span is provided through the entire length of the first floor sales room.

Much skill is required in laying out the terraces used to check erosion if costly earthmoving is to be avoided.

Engineering Opportunities In Soil Conservation

Arthur W. Emerson
Chief, Regional Division of Information and Education, Soil Conservation Service, Lincoln, Neb.

***Contents in Brief**—A relatively new field of engineering that requires the services of hundreds of engineers has been opened up by the work of the Soil Conservation Service. While not spectacular in character, these operations require a knowledge of the fundamentals of civil engineering plus familiarity with soil types. They present numerous opportunities for the exercise of skill in design.*

FOR GENERATIONS Americans have treated land wastefully. Through exploitive farming the soil has been exposed to the ravages of uncontrolled erosion and impoverishment. Productivity of the land has been seriously undermined as a result of indifference towards the forces leading to soil wastage and insecurity of farming operations. Within the past 12 years, however, the picture has undergone a remarkable change. The Soil Conservation Service has been developing and attempting to carry out a comprehensive program of soil and water conservation through the medium of technically trained personnel working with farmers and ranchers right out on their land. During this time a concerted effort has been made to collect, evaluate, and summarize all information having a bearing on the total needs for conservation work. This information is now being made available to agricultural technical people and supervisors of soil conservation districts.

The nature of the various programs now administered by the Soil Conservation Service diverts automatically a large share of the field responsibilities to the engineers of the service. The development of purchased submarginal lands involves a variety of engineering activities. Construction of fences, roads, water impounding dams for rangelands, as well as other structural improvements, are required on areas to be used for recreational and wildlife purposes. The departmental drainage and irrigation activities, two well-established fields of engineering, place additional responsibilities on the service. Work called for under the Case-Wheeler Act, transferred to the Soil Conservation Service as of March 30, 1945, is to promote proper land use by providing numerous engineering installations of some magnitude. These are in addition to the tremendous engineering jobs on the average American farm, six million of them.

Engineering fundamentals involved

Soil conservation engineering is not a spectacular type of work; it involves rather a variety of comparatively small works scattered over large areas, the majority of which must be applied on a farm unit basis. Yet, to be well done, it requires the highest type of engineering ability. The same funda-

mentals of hydraulics, mathematics, physics, mechanics, etc., that are used in established fields are necessary, but they require new applications. Engineers engaged in agricultural work soon discovered that the prevention of erosion, the drainage of flat lands, or the irrigation of arid farms was not simply a matter of building structures or designing hydraulic channels. Of greater importance is the drafting of a comprehensive procedure to harmonize with proper land use, cropping requirements, variations in soil types, and farming practices or organization. *A distinct field of soil conservation engineering is unfolding.*

During this period of demonstration, the growth and development of the Soil Conservation Service and the evolution of the soil conservation engineer, 48 states and Puerto Rico have enacted soil conservation district laws. The people in those 48 states and Puerto Rico have organized as of May 1, 1947, a total of 1,826 soil conservation districts, embracing within their boundaries 976,394,873 acres of land and 4,312,253 farms—over three-fourths of the crop and range land and over two-thirds of all the farms and ranches of this country.

With the passing of the first state soil conservation district law, early in 1937 by the State of Arkansas, and the chartering of the first soil conservation district by North Carolina later in the year after it had also enacted a soil conservation district law, the united action program for soil erosion control was under way.

The soil conservation job on the land is being administered by the people and for the benefit of the people, with the assistance of local, state and federal agencies when asked by the local people to cooperate and furnish technical assistance and guidance, and only then.

Many types of work

Upon request from district supervisors, the Soil Conservation Service is furnishing most of the needed technical assistance. Working in cooperation with farmers and ranchers, SCS technicians are assisting in the layout and establishment of terraces, contouring, strip cropping, soil conserving rotations, stubble-mulch farming, farm drainage, land leveling, farm irrigation systems, irrigation

Three stages of an operation designed to check serious erosion are here shown. At the top, an ever deepening gully endangers a highway bridge and adjoining farm land. The drop-inlet culvert that replaced the bridge is shown in the middle picture, and below, silt has filled the gully up to the inlet level thus checking enlargement of the gully. Erosion upstream will be checked by the reduced slope of the valley, thus stopping progressive extension of side gullies into the adjoining farm land.

Soil conservation engineers are confronted with a wide variety of engineering responsibilities varying from the design of small check dams to the design of storage dams of considerable magnitude.

structures, protected waterways, gully control, water spreading, better land utilization, farm forestry, woodlot development, and improvement of wildlife and human environment, all in line with the productive capacity and capabilities of each acre of land on each farm.

In practically every one of these land-protection and land-use jobs, we can see transits, levels, steel tapes, drawing boards, maps and engineers. With this job before us on 20 million acres of irrigated land and new acres which will come under the ditch in these post-war years; the 39 million acres of productive land needing drainage; the 100 million acres needing terracing; the 720,000 acres which are in need of pond improvement and management; the 400 million acres in need of range management plans; the 122 million acres needing contour farming layouts; and all of the hundreds of millions of acres which need other soil conservation practices, trained engineers are essential.

We can, I believe, understand better the engineering job in soil conservation after reviewing district supervisors annual reports of representative districts, taking first the Phelps-Gosper, Soil Conservation District, Holdrege, Neb.

The land in this district has been farmed as dry land for almost 70 years. There are 712 farming units in the district and the area comprises approximately 350,712 acres of land. There are 150,000 acres of irrigable land; 40,000 acres were receiving water at the time of the district's organization. On Nov. 5, 1943, a memorandum of understanding between the district and the U. S. Department of Agriculture became effective. The Soil Conservation Service assigned technicians to the district and a district office was opened immediately.

Quoting from the 1944 annual report, the first full year of operation, "The technical assistance given the district by the Soil Conservation Service has not been enough to meet the demands of the farmers within the district. The 103 applications on hand at the beginning of the year, plus the 143 received in 1944, have created a demand for assistance that could not have been met with *two or three times* the number of *technicians* that were available. Practically all of the requests are in connection with the development of the irrigation systems on the individual farms. This requires engineering surveys for planning. The locating of ditches, and structures and staking for land leveling, necessitate a great deal of technical time.

TABLE I—SOIL CONSERVATION WORK OF THE BOX ELDER DISTRICT EKALAKA, MONT.

Job	Accomplished to date 1942-46	Left to do
Flood irrigation	26,734 acres	13,168
New diversion canals	123 miles	297
Farm distribution system ditches	119 miles	941
Flood-control dikes	113 miles	252
Storage dams	30 dams	8
Diversion dams	223 dams	531
Stock water reservoirs	647 reservoirs	24
Wells	54 wells	44
Structures—drops, weirs, etc.	210 structures	283

TABLE II—OPERATIONS PLANNED FOR THE TURKEY CREEK DISTRICT IN NEBRASKA

Practice	Established	Total planned	District needs
Contour planting—acres	22,333	33,975	116,000
Terraces—miles	488	3,636	12,500
—acres	4,880	36,360	125,000
Outlets for water courses—acres	1,594	2,991	9,750
Contour furrowing,—acres	2,446	11,671	44,900
Ponds and dugouts,—number	71	221	800
Gully diversions—feet (length)	68,395	320,580	1,120,000
Farm drains—area in acres	125	287	800

Much equipment needed

Following is another quote from a Phelps-Gosper report which I believe is one of the real problems confronting the engineering profession for developing sound and economical land-use programs: "The need for heavy equipment will increase as more land comes under irrigation. At one time this season there were 26 land leveling outfits operating in the district. There are two contractors who operate one leveling rig apiece, and who have kept their equipment in the area all the time.

"All of the work done in leveling land for irrigation has not been satisfactory. Many of the jobs done by contractors have proven to be 'money wasted' for the farmer. Much of this trouble has been caused by doing the job by *guess and without making necessary engineering surveys.* Contractors have not always been able to obtain or furnish adequate engineering service. Most of the farmers realize this, and the district is endeavoring to furnish as much engineering as possible."

Citing another phase of the soil conservation district program and the need for land-use engineering technique, let us look at a district in the range country of Montana: The Box Elder Soil Conservation District, Ekalaka, Mont., has 1,900,000 acres of land and has planned 1,356,930 acres for 264 farm and ranch units. We will talk about the 1,356,930 acres of land and the job in that district which requires engineering by citing their accomplishments and what is left to do, as shown in accompanying Table I.

The above figures represent about 75 percent of the job to be done—25 percent of the job has yet to be planned; also, as the original plans are put into effect, new jobs continually arise toward perfecting the district program. Soil conservation is a continuing progressive job.

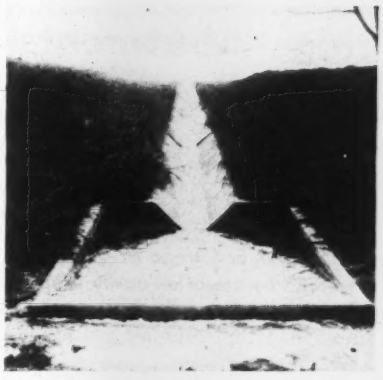
These jobs demand the services of engineers acquainted with a soil conservation land and water use kind of engineering technique just the same as highway construction, mining, and other phases of the engineering profession.

An example of the drainage work ahead is typified by a report prepared by Edwin Freyberger, regional engineer of the SCS, Milwaukee, Wis., on a mutual drainage association:

"Additional insight into the drainage job in the United States can be gained when we review what the CCC camps accomplished on 12 million acres of land during their period of operation. The job of rehabilitation and improvement in this instance included the digging of 6,444 miles of ditches and the removal of 64 million cubic yards of silt, mainly eroded soil deposited in the ditches. It included, also, cutting out obstructive vegetation from almost 11,000 miles of ditches, the rehabilitation of 340 miles of main outlet tile drains, and the leveling off of more than 3,000 miles of obstructive spoil bank material."

Terracing and contouring

The fourth phase of the soil conservation job in districts—by far the largest and the one needing the most technical assistance—deals with terracing. contouring farming and land-use adjustments, using each acre of each farm for the purpose for which it is best adapted. And again, we will review the 1946 annual report of a soil conservation district, this time the Turkey Creek Soil Conservation District in Pawnee County, Neb., representing the cornbelt. It has 287,113 acres of land and 1,450 operating units within its boundaries. The supervisors have 533 farm plans completed for 87,159 acres; 178 farm plans partly completed; and 683 operating units which they haven't gotten to as yet. The job accomplished and the amount still to be done is given in Table II.



Erosion of slopes is prevented by the construction of "trickle spillways" of this type.

And these are only the engineering jobs. Others are subsurface tillage, rotation hay and pasture, rotated grazing, seeding for range and pasture, seeding for hay, farmstead windbreaks, field and gully plantings, etc. One point, for comparison, 4,880 acres terraced of the 125,000 acres needing terraces. In the United States, approximately *four million* acres of land have had terraces completed on them; *100 million acres* need terraces. This job needs technically trained men for layout, and contractors with the "know how" to construct them. At $10 an acre, there is almost a billion dollars of construction work in only this one phase of the soil conservation program.

Soil conservationists have completed a detailed soil survey on 234 million acres of the billion acres of farm and range lands of this country. This survey is so thorough that they know the extent of erosion, the supply of water, needs for drainage, the slope, fertility and soil type for every acre. These land-use capability maps are an inventory of every acre of land and what it is best suited to be used for. This survey furnishes a blue print to blow up in the forecast of soil conservation work ahead and the personnel needed to do the job.

The conservationists believe if sufficient technical assistance were available it would be possible in two or three years' time to make preliminary surveys on the balance of the farmlands of the nation. There will also be needed 1,500 conservationists trained each year for the next ten years—a minimum total of 15,000—if the soil conservation job is to go forward. A large percentage of these men must be trained in the techniques of soil conservation engineering.

Land leveling and the construction of irrigation structures to serve the land is a task calling for the development of special skills.

Battered Piles in Bridge Abutments

CHARLES H. WOOD
Senior Civil Engineer, Retired
New York State Department of Public Works, Albany, N. Y.

Contents in Brief—Determination of the number and slope of batter piles needed under bridge abutments can be simplified by use of an easily prepared diagram. A typical example outlines the procedure.

It generally is considered good engineering practice to batter some of the piles in a bridge abutment to provide resistance against the earth pressure on the back. This article presents a simple method for finding the proper number and slope of the battered piles.

Six loads are considered:

C=Weight of concrete in abutment assumed as 150 lb. per cu. ft.

F=Weight of gravel backfill—130 lb. per cu. ft.

D=Dead load reaction from the bridge superstructure.

L=Live load reaction from bridge superstructure.

H=Active earth pressure, assuming an equivalent hydrostatic pressure from a liquid weighing 38 lb. per cu. ft.

HS=Earth pressure from an assumed live load surcharge of 200 lb. per sq. ft., producing a uniform horizontal pressure of 60 lb. per sq. ft.

L and *HS* are assumed *not* to act simultaneously. The weight of the live load surcharge on the back of the abutment is disregarded.

A typical abutment is shown in the illustration. Timber piles are used.

For the maximum vertical reaction on pile row 1 use all the loads but *L*.

For the maximum on pile row 5, use all the loads but *HS*.

For pile row 1, the resultant intersects the base near pile row 3, 8.87 ft. from the back edge of the footing. It is computed as follows:

$$\frac{(18{,}000 \times 8.08) + (18{,}200 \times 3.25) + (7{,}240 \times 9)}{18{,}000 + 18{,}200 + 7{,}240} = \frac{269{,}750}{43{,}440} = 6.21$$

$$6.21 + \frac{(11{,}850 \times 8.3) + (1{,}440 \times 12)}{43{,}440} = 8.87$$

For pile row 5, the resultant intersects the base at 8.50 ft. from the back edge of the footing. It is computed as follows:

$$\frac{269{,}750 + (2{,}650 \times 9)}{43{,}440 + 2{,}650} = 6.37$$

$$6.37 + \frac{11{,}850 \times 8.3}{46{,}090} = 8.50$$

Assume the center of gravity of the pile group about midway between Points A and B, say at 8.75 ft. from the back edge of the footing. The moment of inertia of the pile group = $(6^2 + 3^2)\ 2 = 90$.

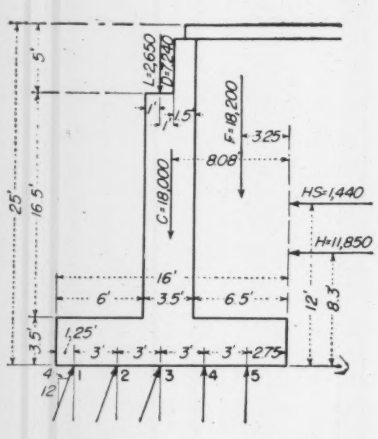
Vertical load per lineal foot of abutment on pile row 1 = 43,440[1/5 + (8.87 − 8.75) 6/90] = 9,040. Vertical load per lineal foot of abutment on pile row 5 = 46,090 [1/5 + (8.75 − 8.50) 6/90] = 9,980.

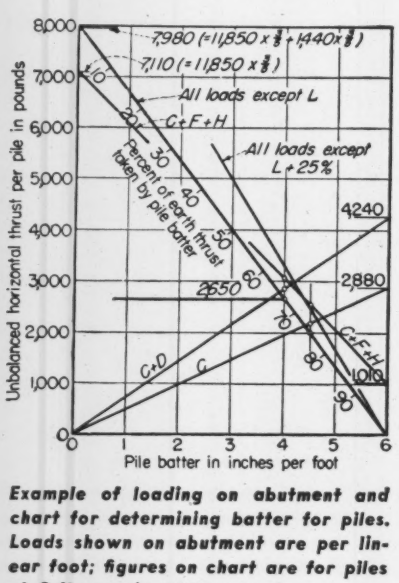
Space the pile rows 3 ft. apart and assume that the secant of the batter angle will be about 1.06.

Maximum axial load on pile 1 = 9,040 × 3 × 1.06 = 28,700. Maximum axial load on pile 5 = 9,980 × 3 = 29,900. The maximum allowable load for timber piles is 30,000 pounds.

A tabulation is now made, as shown, giving the vertical reaction on each pile row per transverse linear foot due to each of the six loads. From this tabulation, the maximum vertical load per linear foot of abutment on pile row 1, using all the loads but *L*, is 2,800 + 1,570 + 6,560 + 1,150 − 3,040 = 9,040. The maximum vertical load per linear foot of abutment on pile row 5, using all the loads but *HS*, is 4,400 + 10,320 + 1,330 + 490 − 6,560 = 9,980.

These results of 9,040 and 9,980 check those already found by another method. The load on pile row 1 is kept lower than that on pile row 5 to allow for the increase in axial load due to the batter.





Example of loading on abutment and chart for determining batter for piles. Loads shown on abutment are per linear foot; figures on chart are for piles at 2-ft. spacing transversely.

How to determine the slope

Three load combinations are considered.

I. $C + D$. This is a temporary condition.

II. $C + F + H$. This is also a temporary loading.

III. All the loads except *L*.

The criterion is as follows: The sum of the horizontal components of the axial loads on the battered piles in load combination I ($C + D$, a temporary loading) tending to push the abutment back, or the difference between the earth pressure and the sum of the horizontal components in loading II ($C + F + H$, also a temporary condition) tending to push the abutment forward, may exceed the difference between the earth pressure and the sum of the horizontal components in loading III (all the loads except *L*) tending to push the abutment forward, by about 25 percent. Subject to the above limitation the proportion of the earth thrust in

VERTICAL LOADS PER LINEAR FOOT TRANSVERSE TO ROADWAY

Loading	Pile 1	2	3	4	5	1+2+3
C	2800	3200	3600	4000	4400	9600
F	−3040	300	3640	6980	10320	900
D	1570	1510	1450	1390	1330	4530
L	570	550	530	510	490	1650
H-11850	6560	3280	0	−3280	−6560	9840
HS-1440	1150	580	0	−580	−1150	1730

Loading III taken by the batter piles should be as large as possible.

This difference or unbalanced thrust is assumed to be taken by the uniform resistance of all the piles, straight and battered, to lateral displacement.

Two, three, four or all rows may be battered; the more that are battered the less the required slope. In the example, the three front rows are battered with the same slope. The transverse pile spacing is 3 ft.

With the help of the tabulation, the chart shown can be made with little difficulty.

For Load I, $C + D$, with no batter piles, the unbalanced thrust would be zero. With 6 on 12 batter, the unbalanced thrust per pile would be $(9,600 + 4,530)\ 6/12 \times 3/5 = 4,240$. Plot these two points and connect by a straight line.

For Load II, $C + F + H$, with no battered piles, the unbalanced thrust per pile would be $11,850 \times 3/5 = 7,110$. With 6 on 12 batter, the unbalanced thrust per pile would be

$$(11,850 - \frac{9,600+900+9,840)}{2} \times 3/5 = 1,010.$$

Plot these two points and connect by a straight line.

For Load III, all the loads but *L*, with no batter piles the unbalanced thrust per pile would be $(11,850 + 1,440)\ 3/5 = 7,980$. With 6 on 12 batter, the unbalanced thrust per pile would be

$$(11,850+1,440-\frac{9,600 + 900 + 4,530 + 9,840 + 1,730)\ 3/5}{2}$$

$$= (13,290 - \frac{26,600}{2})3/5 = -6, \text{ say zero}$$

Plot these two points and connect by a straight line. Divide this line into tenths to indicate percentage of $H + HS$ taken by horizontal components of the axial loads on the batter piles for each batter angle. Above this line plot Loading III plus 25 percent.

Inspection of the chart shows that a batter of 4 on 12 on pile Rows 1, 2 and 3 satisfies the criterion. Under Loading III, the unbalanced horizontal thrust per pile is 2,650 lb.; the percentage of the earth thrust taken by the horizontal components of the axial loads on the batter piles is 67.

The secant of the angle whose tangent is 4/12 is 1.054.

The maximum axial load on Pile 1 is $9,040 \times 3 \times 1.054 = 28,600$.

If the specifications are so written that the bridge superstructure can not be erected until the backfill is in place, as might be advisable in poor material, Loading I becomes *C* only, and the unbalanced thrust per pile, with 6 on 12 batter would be $\frac{9,600}{2} \times \frac{3}{5} = 2,880$.

Draw a straight line from zero to 2,880. Inspection of the chart shows that a batter of 4½ in 12 would satisfy the criterion. The unbalanced thrust per pile would be reduced to 2,000; the percentage would be increased to 75.

The secant of the angle whose tangent is 4.5/12 is 1.068.

Maximum axial load on pile 1 would be $9,040 \times 3 \times 1.068 = 29,000$.

Instead of using a batter of 4 on 12 in rows 1, 2 and 3, as shown in the example, 4½ on 12, 4 in 12, and 3½ in 12 could be used in rows 1, 2 and 3, respectively. This arrangement would make the piles diverge.

The method described for determining batter pile requirements is applicable to retaining walls, in which case *D*, *L* and *HS* are eliminated.

Cities Score Record Growth

Setting a new record of urban expansion, 259 U. S. cities extended their boundaries to include suburban territory during 1946 according to the International City Managers' Association. This marks a 70 percent increase over city annexation in 1945.

Among the cities that have taken this action to control metropolitan "fringe" growth, 152 were of over 10,000 population. Statistics gathered for the 1947 Municipal Yearbook show that 42 cities annexed areas of one-half to one square mile. Of the remainder twenty-five contained one square mile or more.

In 1945, only 150 cities added new land, 87 of which were of over 10,000 population. Increased annexations reflect city efforts to adjust to record-breaking growth of metropolitan areas during the war, and to anticipate a continued suburban building boom.

Fort Worth, Tex., scored the greatest area growth last year of any city —annexing 35 sq. mi. of land by charter amendment election Dec. 17. This triples the city's topographic size by increasing its area from 17.1 to 52.1 sq. mi. In the previous year, the biggest annexation was made by nearby Dallas, which annexed a 39 sq. mi. area.

Annexation generally provides for equalized local tax rates and uniform public services, and facilitates long-range community planning. Suburbs usually resist annexation to their parent city because it sometimes means more taxes for suburban residents. A recent singular exception to this resistance is Westwood, an incorporated suburb of 7,000 which recently voted for annexation to Denver, Colo. Most annexations are of unincorporated territory.

To help clarify for new residents just what annexation means, Kansas City, Mo., recently distributed a booklet entitled "A Message of Welcome From Your City Government" to residents of a newly-annexed area containing a population of 10,000.

The pamphlet outlines briefly the major municipal services, contains a chart showing percentage distribution of revenues and expenditures of the city, and gives a detailed list of services available through the public works department. In addition to this new area, Kansas City voters last fall annexed 19 sq. mi. in Clay County north of the city, effective in 1950.

Radiant Heating for Schools Simplified by Use of Copper Tubes

Effective use has been made recently of copper tubing in the radiant heating systems of several northern California schools. Such systems are being installed in increasing frequency and these jobs are typical examples of this work. Primary advantage claimed for the use of copper tubing is ease of installation. This is illustrated by job progress figures on one of the California schools where a crew of three men (a welder, a plumber and an apprentice) installed as much as 3,500 ft. of tubing in one 8-hour shift and no shop prefabrication was required.

The heating system is designed to maintain the school rooms at 65 deg. F. when it is 30 deg. F. outside. Some 544,000 B.t.u. per hour are required to heat eight 32x32-ft. classrooms with lavoratories and a mechanical room. Four gas-operated water heaters supply this heat. Water at about 130 deg. F. is circulated through a system of ½-in. copper tubes laid so that there is 1 ft. of tube for each square foot of floor surface.

Because of the ease of handling copper tube, construction forces of small heating contractors can readily be trained to install these systems. All bends are easily made in the field. Joints are less frequent than with wrought iron pipe and are made with a simple sleeve coupling sealed with silver solder by a welder using an ordinary oxy-acetylene torch.

Although material costs are higher, over-all costs are usually lower on copper tube radiant heating systems because of less expensive installation changes. However, some heating contractors with proper equipment and experience on wrought iron systems have overcome this cost advantage.

Tempered air is used in conjunction with radiant heat in some of the schools. Air is circulated by a forced draft system and the fresh air brought in from the outside is heated or tempered to 65 deg. F. No open windows are required for fresh air. Another 544,000-B.t.u.-per-hr. capacity is required for air tempering.

Control is provided by a thermostat mounted in each room. This is considered adequate and reliable in California where daytime changes of temperature are rarely sudden. However, a new system has recently been devised whereby the thermostat is located outside to account for the time lapse necessary to change the school rooms to proper temperature. Thus, with any sudden decrease or increase in outside temperature that would not be seriously felt in the school rooms for, say, 2 or 3 hours, the heating system adjusts accordingly.

Special attention was given in these California schools to the matter of lighting, with an attempt made to provide as much natural light as possible. In one case, the building is one story high with the long axis running east and west. The entire north side is made of glass with a short eave or overhang and the south wall is solid for the lower 3 ft. and of glass in the remainder. A long overhanging eave keeps out direct rays of the sun during classroom time. Because of the width of the room, a skylight 8 ft. wide is provided along the ridge of the building. This skylight is made of glass that will admit light, but not the direct rays of the sun.

Typical of these schools described are the Laurel Creek Elementary School in San Mateo, Calif., and the Charter St. Elementary School in Redwood City, Calif. Design was by Franklin, Kump and Falk, architects and engineers, San Francisco, Calif.

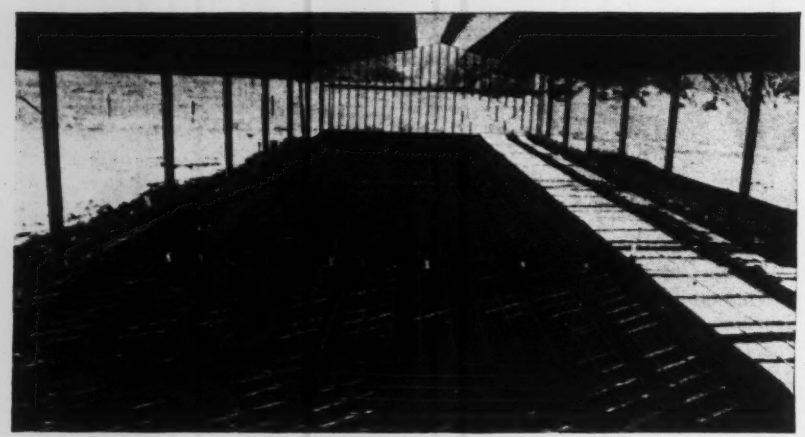


Fig. 1. Radiant heating coils ready for the pouring of the floor slab in a California school. Copper tubing was used because of ease of installation.

Fig. 2. No shop prefabrication was needed for the installation of the copper tubing radiant heating coils.

Bureau of Reclamation (Russell) photos

Well-ordered physical development at Boulder City belies the muddled administrative pattern to which it must conform.

There's no Place Like Boulder City

***Editor's Note:**—Boulder City, Nev., presents a unique situation in municipal administration. Originating as a necessary adjunct to the construction of Hoover Dam, it was built with federal funds, is managed by the Bureau of Reclamation, and its operations are financed in large part with revenues from public and private power contractors. The 5,000 people living in the city enjoy freedom from local taxes or general assessments, but they chafe under the system that denies them any voice in the management of community affairs. The Reclamation Bureau is not particularly happy with its assignment as city manager, and the power contractors object to overhead charges that have little relation to their operations. What to do about this muddled situation is a matter that only the Congress—which created the town with the Boulder Canyon Project Act of 1928—can decide.*

FOCAL POINT of hundreds of thousands of tourists this year—and a stopover for special trains carrying delegates ot the water and sewage works conventions at San Francisco in July—is Hoover Dam. Not so obvious as the dam, but equally unique in its own rights, is Boulder City, Nev., on the mesa above the dam.

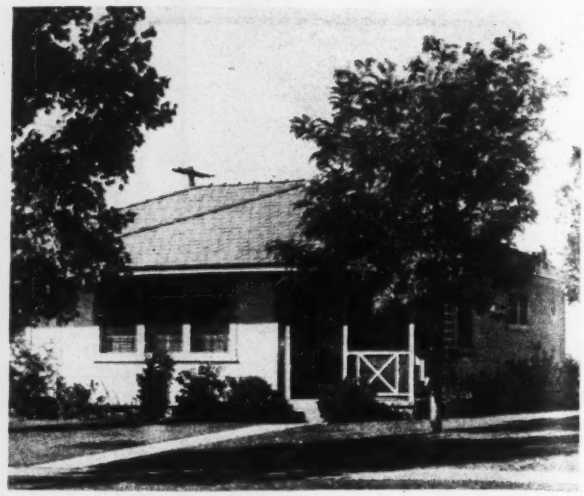
Municipal administrators and engineers will find here a city of paradoxes. Its green lawns and trees form a luxuriant oasis in an otherwise barren stretch of desert. Its pleasing layout and well designed street and parking areas reveal the skill of an expert city planner—yet his name and the names of others who developed the plan cannot be found in any of the town records.

Every aspect of the place reflects particular care and good management. Yet there are no elected officials, local taxes or general assessments. And there is an annual operating deficit of more than a half million dollars.

Adjacent to the largest man-made lake in the world, Boulder City is in the embarrassing situation of being short on water. And the effluent from its sewage treatment works needs no dilution because but a mere half mile from the outfall it disappears in the desert sand.

Only 23 miles away is Las Vegas, the mecca of those who would test their fortunes at the gaming tables or lose their frustrations at the bar. At Boulder City there is neither gambling nor liquor.

No haven for criminals, and completely free of any crime originating within the community, yet it is one of the most strategic points in the United States for the apprehension of law breakers. The reason—the crest of Hoover Dam serves as the only bridge across the Colorado River for at least a hundred miles in both di-



Small homes, which characterize Boulder City, are surrounded with lawns, trees and shrubs, whose growth in the desert is made possible only by ceaseless watering. The left view shows a privately owned residence; the one at the right is typical of those owned by the Southern California Edison Co. and occupied by employees engaged in operating power facilities at nearby Hoover Dam.

rections and every car that crosses is checked by rangers who are stationed at each highway entrance to the dam area.

Finally, those who are charged with the operation of the town are not particularly fond of the job. And the citizens in it are not at all happy over the way it is operated. Neither one can do anything about it except through the action of Congress.

These are some of the paradoxes at Boulder City—a place where thousands want to live but only a few can be accommodated.

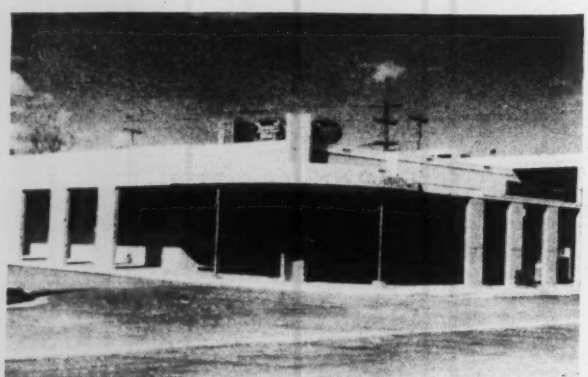
How it happened

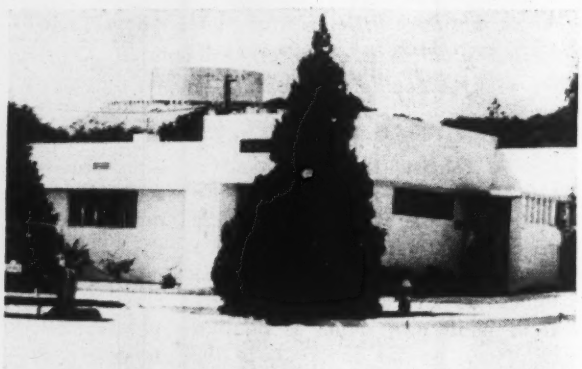
Background for an understanding of the situation is contained in a report of the Bureau of Reclamation submitted to the Secretary of the Interior last year. This report eventually may serve as the basis for action by the Congress in clarifying the status and operation of Boulder City. In so doing, it might provide the pattern for operation of at least two other communities—Grand Coulee and Davis—which some day will find themselves in about the same administrative muddle as Boulder City.

The report points out that the development of Boulder City as a townsite was necessitated by the isolated location of the site of Boulder Dam, which was some 30 miles in the desert from any settled community. Construction of the project required housing and community facilities for a large force of men during a period of from three to seven years, following which certain facilities were needed to accommodate those who would operate the project.

During the construction period, the total townsite area was occupied to practically maximum capacity by a population of some 8,000. By 1937 when the greater part of the work had been completed, the population dropped to about 2,500. During the war, increased activity brought the population back to some 6,000, and at the present time it is about 5,000.

Situated on reserved lands of the United States, the town is operated by the Bureau of Reclamation as a part of the Boulder Canyon project. Municipal facilities, public buildings, schools, a hospital (operated by the U. S. Public Health Service) and a part of the residence housing required





Community service activities are conducted by private business interests under a system of permits. The buildings stand on lots leased from the United States. Boulder City is situated on reserved lands of the federal government.

by government employees are owned and operated by the federal government on a revenue-producing basis to the extent feasible.

All commercial activities to service the community are conducted by private business interests, under a system of permits, in buildings owned by them on lots leased from the United States. Privately owned residence housing is also situated on lots leased for the purpose from the United States.

These private interests share part of the cost of municipal operation through the payment to the United States of ground rents, business licenses and utility rates; in addition they pay taxes to the State of Nevada and the local school districts for educational purposes.

There is no privately owned industrial development in the town. However, in addition to the immediate operation of Hoover Dam and power plant, facilities, which is the predominant local activity, the federal government has other activities in Boulder City which, while incidental to the project, serve primarily regional and national needs. These include the pilot plant and metallurgical laboratory of the Bureau of Mines, the regional office of the Bureau of Reclamation, and the National Park Service which administers the recreational area surrounding Lake Mead.

The water-treatment plant, which provides filtration, softening and chlorination, has a rated capacity of 2 mgd. but often must turn out an additional half-million gallons to cope with demands. Irrigation and cooling water in this desert country accounts for 75 percent of the requirements.

ENR Staff photos

A settling tank and sludge digester comprise the sewage treatment facilities. The effluent from the plant, which drains into a ditch on the desert, disappears from view a half mile from the plant.

Power contractors pay the bill

In the past, in accordance with law, all municipal expenditures in excess of applicable revenues, have been charged to current project operations and included in the financial obligations of the power contractors. These contractors are the Department of Water and Power of the City of Los Angeles and the Southern California Edison Co., who act as agents of the United States in operating the generating equipment. The dam, reservoir, power-plant building and the municipality are operated by employees of the Bureau of Reclamation.

The position of these power contractors and their interest in the operation of Boulder City stems from the contract between the United States and the several allottees of Hoover Dam power. Briefly, under these contracts, the United States agreed to make available for the period June 1, 1937 to May 31, 1987, the electrical output of the project to the contractors who on their part agreed to meet all current expenditures for operation, maintenance and replacement of the project. In addition, they agreed to repay the original advances (less $25,000,000 for flood control) within the 50-year period with interest at 3 percent; furthermore, they are to repay a part of any additional advances on the basis of repayment with interest within a 50-year period.

The costs that the contractors have agreed to meet are carefully defined in most respects. But in the case of net deficit arising from the development, maintenance and operation of Boulder City, their responsibility is not exactly defined, particularly with respect to costs arising from activities not directly related to the operation of the project for power production or not originally contemplated as part of other project operations.

Department of Interior position

The position of the Department of the Interior, as stated in the report, is that while the obligations of the power contractors with respect to Boulder City costs may not be exactly defined by the contracts or by legislation, the contractors do have an essential obligation to develop,

operate and maintain the town as project operating headquarters.

It is argued that the project could not operate without the town or its equivalent. And the fact that the town and the project operations have attracted certain other governmental and private activities which are incidental to immediate project operation, but not necessary to it, is said not to change the primary obligation.

However, continues the report, it seems just that these other activities should meet the additional costs directly attributable to them. In the case of other governmental activities, this may be accomplished by deferring repayment of applicable costs beyond the life of the power contracts and in the case of private activities by the collection of assessments, charges and fees.

Since it is impossible to forsee the nature and extent of the activities that the project and its operating town may attract during the life of the power contracts, and what the changing equities may be, the recommendations in the report, therefore, seek to define broad general principles of procedure rather than to set up hard and fast rules.

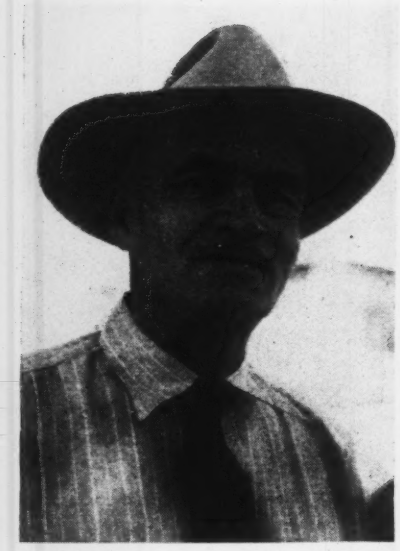
It becomes apparent, for example, in reviewing Boulder City operations, since June 1, 1937, that it is essential to orderly municipal development and the equitable distribution of costs to establish definitely defined administrative procedures.

The Secretary of the Interior has lacked specific legislative authorization to make and enforce comprehensive regulations for the allocation of costs, the making and collection of appropriate charges and the establishment of effective municipal government.

The legal residents of Boulder City are citizens of the State of Nevada and may and do vote in all state and national elections. But they have little participation in municipal matters and do not at present assume full financial responsibility for the cost of such local improvements and services as directly benefit them.

Recommendations for consideration

Appointment of a city manager who will be responsible for the administration of the municipality and the creation of an elected board or council that will participate in the government of the town, are recommended as a means of correcting the situation.



A. G. Boynton, engineer-in-charge at Boulder City holds a unique city manager's post.

On the financial side the report discloses that as of May 31, 1945, the total net cost of Boulder City to the power contractors had been $1,056,741. A part of this total is directly attributable to immediate project operations, another part is for the direct benefit of other governmental activities and a further part should be apportioned between the first two classes of activities on the basis of area occupied or number of employees, whichever is more reasonable in the particular case.

The overall result of the recommendations with respect to past costs is that $896,300 be allocated to immediate project operations to be paid by the power contractors. The balance of $160,500, which also represents project costs in the sense that it is expenditure on property of the United States on the Boulder Canyon project, should be allocated to other governmental activities and deferred until the expiration of the power contracts in 1987 and then repaid to the Treasury by project revenues subsequent to that date. Adjustments with the power contractors are to be made at the annual rate adjustment.

The report and recommendations, submitted to the 79th Congress last year, were not acted upon.

Meantime the residents of Boulder City are said to be in the throes of unrest—they demand some voice in the management of the town. A few express the view that they are living under nothing more than a dictatorship.

The power contractors, likewise, are dissatisfied. In fact, they have been insisting for years that changes be instituted to relieve them of what they consider unfair and extraneous charges in operating municipal facilities.

Bureau in a tough spot

Feeling the squeeze from both sides is the Bureau of Reclamation. It is not a function of the bureau, of course, to engage in the operation of a municipality. But under the Boulder Canyon Act, it was charged with the development of a town for the construction of a dam. Until that act is amended, the bureau cannot get out from under. And, as one spokesman put it, "administration of this place is a big headache."

When the municipality began operations in 1931, the bureau operated Boulder City through a city manager, who reported to the construction engineer on the project. Since 1943, overall supervision has been lodged in the office of the Director of Power. The director, in turn, delegates authority to an administrative officer. While the functions of the latter are akin to those of a city manager, he does not hold office at the discretion of the people he serves.

With everybody in Boulder City wanting a change, it might be supposed that sentiment would be crystallized on just what should be done. But, paradoxically in a city of paradoxes, this is not the case. Sometime soon the Congress of the United States must make the decision.

Faith of the Engineer

An enlargement of the "Faith of the Engineer" as reproduced on page 495 of the April 4, 1944, issue of *Engineering News-Record* has been made by the Engineers Council for Professional Development and has been printed on rag-paper sheets size 17x22 suitable for framing for use in schools and clubs where a large type is desired. Copies can be obtained from the E. C. P. D. office at 33 West 39th St., New York 18, N. Y., for $3. Smaller copies, size 8½x11, also are available at 50 cents each.

West Virginia Pushes Pollution Control

***Contents in Brief**—West Virginia is classifying the quality of water in its streams. A zoning map has been completed for the Kanawha River Valley and rating studies for Ohio and Potomac basins are well-advanced. Cooperating with state officials, numerous industries and cities have announced projects for the construction of treatment facilities. Many of these projects are sufficiently planned so that construction may be started this year if economic conditions become favorable.*

POLLUTION abatement activities of the West Virginia State Water Commission have been expedited and work is going ahead rapidly on plans for extensive improvements. Water-classification zoning was completed recently for the Kanawha River basin and zoning of that portion of the Potomac River basin in West Virginia has been started. Furthermore, the commission hopes to have zoning well advanced on its sector of the Ohio River by the end of 1947.

The commission was created by the state legislature in 1929. Before the war much was accomplished in conjunction with the West Virginia State Department of Health, including installation of treatment facilities by numerous coke-producing plants and tanneries in West Virginia. But loss of key men for military service caused curtailment of many operations.

With the return of engineers and increased need of pollution abatement work created by war-inspired industrial expansion in West Virginia, the commission has been revitalized. Also, greater financial support has been made available and instructions have been given to step up work appreciably.

Three types of work

A three-point program is being carried out, the major projects being: (1) Classification of every mile of all major West Virginia streams into one of four water-quality zones; (2) a cooperative program to reduce industrial pollution of the state's streams; and (3) assistance to municipalities in their abatement work.

As the first operation of part one, the specifications shown in accompanying Table I were prepared in order to classify West Virginia rivers. From these standards a basic zoning map showing the present water classifications is being constructed on each watershed. The standards provide for four zones of water — Classes AA, A, B, and C. Quality varies from Class AA (satisfactory for a municipal supply with minor treatment) to Class C (unsatisfactory for a municipal supply without extensive treatment).

The accompanying map shows the zones on the Kanawha River. Only main streams have been classified, since tributaries are mostly of the same or higher classification than the main stem. Some branches are exceptions. In these cases the reason for lower quality in the tributary will be determined.

Study of the zoning map for the Kanawha River watershed reveals a limited mileage qualifying for Class AA classification. Most of its length falls into Class A; of the remainder slightly more mileage comes under Class C than Class B. A symbol adjacent to each zone reveals water characteristics.

For example, the symbol given for the river below Charleston indicates four factors that placed this sector in Class C. Letter "C" shows that the water has high coliform content and letter "D" indicates dissolved oxygen content that averages less than 3.0 ppm. During some months this value fell below 2.0 ppm. on critical days. Five-day Biochemical oxygen demand—over 6.0 ppm. during months of maximum pollution and above 10.0 ppm. during the most

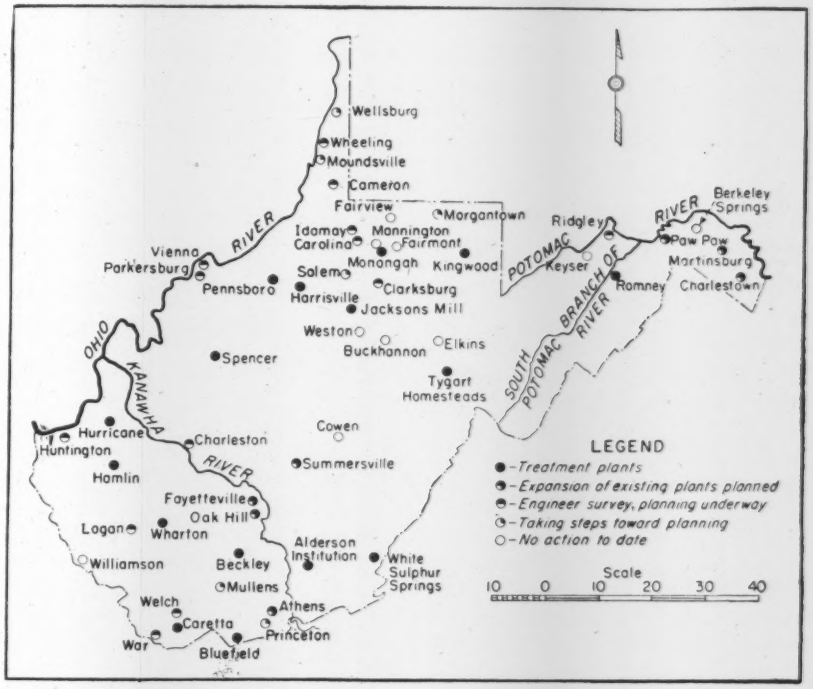


Fig. 1. Cities lacking adequate plants are making progress in preparation of plans for sewage treatment facilities. Many cities with inadequate disposal are planning improvements; only a few towns have taken no action.

TABLE I—SPECIFICATIONS FOR THE CLASSIFICATION OF WEST VIRGINIA STREAMS

DETERMINATIONS			CLASS AA	CLASS A	CLASS B	CLASS C
			Excellent source of water supply; excellent fish habitat and recreational water.	Good source of water supply; good fish habitat and recreational water.	Serve as source of water supply with complete and auxiliary treatment; poor fish habitat and recreational water.	Unsatisfactory water supply; unsuitable as fish habitat and recreational water.
NAME	(Zoning Symbol)	Period Covered				
Most probable number Coliform Bacteria per 100 ml.	(C)	Average any month	Not over 100	Not over 1,000	Not over 10,000	Over 10,000
Dissolved Oxygen p.p.m.	(D)	Average any month	Not less than 7.5	Not less than 6.0	Not less than 4.0	Less than 3.0
		Minimum any day	Not less than 6.5	Not less than 5.0	Not less than 3.0	Less than 2.0
5-Day B.O.D. p.p.m.	(B)	Average any month	Not over 0.75	Not over 2.5	Not over 6.0	Over 6.0
		Maximum any day	Not over 1.0	Not over 3.5	Not over 7.0	Over 10
pH	(O_1)	Average any month	6.3–7.7	5.8–9.0	Between 3.8–5.8 or 9.0–10.5	Less than 3.8 or over 10.5
Fluorides p.p.m.	(O_2)	Maximum	Not over 0.5	Not over 1.0	Not over 1.0	Over 1.0
Chlorides p.p.m.	(O_3)	Maximum any day	Not over 100	Not over 250	Not over 500	Over 500
Phenolic Compounds p.p.b.	(O_4)	Maximum	None	Not over 5.0	Not over 25	Over 25
Iron p.p.m.	(O_5)	Maximum	Not over 0.3	Not over 0.3		
Color	(O_6)	Maximum	Not over 20	Not over 100		
Turbidity p.p.m.	(O_7)	Maximum	Not over 10 except as result of heavy rain.	Not over 250 except as result of heavy rain.		
Industrial or Domestic Sludge Deposits	(O_8)		No deposits present	No deposits present	Slight to moderate localized	Moderate to heavy—general
Other Conditions	(O_9)		No toxic substances, oils, tars, or free mineral acid at any time; no floating solids or debris, except from natural sources, only slight amounts of taste and odor producing substances occasionally present.			Toxic substances, oil or tars present at any time; free mineral acidity present frequently; taste and odor producing substances often present.

severe days—is indicated by letter "B". Also, letter "O" with the subscript 9 was added as part of the symbol to indicate toxic substances (oil or tars), frequent free mineral acidity, and substances producing taste and odor.

Potomac basin given priority

During 1947 zoning work in the Potomac basin will be given top priority as part of the cooperative program with other states that are members of the Interstate Commission on the Potomac River Basin. In 1946 numerous samples were taken in the West Virginia portion of the basin. This work will be extended this year.

The Ohio River basin and its tributaries, with exception of the Kanawha, have been given third priority in the program of zoning and stream improvement. Assignment of high priority to this area was made because West Virginia wishes to fulfill as soon as possible obligations assumed after ratification of the Ohio River Compact.

The second major part of the commission's work consists of gaining friendly cooperation from industrial plants to reduce and eliminate eventually pollution in West Virginia streams. This work with industry—which is progressing steadily—is intensified where the quality of the stream is Class C or where heavy pollution is rampant.

For example, intensive sampling and laboratory work was conducted during 1946 for a portion of the Kanawha River, extending from 12 mi. above to 40 mi. below Charleston. As a part of this project 25 industrial plants were inspected by representatives of the state and requested to aid the commission in abatement work. Some eight major industries set up laboratories to work on pollution problems. Also, one plant in the zone has planned a $600,000 treatment unit, the construction of which will start probably in 1947. Another plant will spend about $200,000 in building treatment facilities. A third industry has appropriated $30,000 for preparation of a long-range, effluent-improvement program during 1947. Fortunately, the survey showed that a number of the plants on the lower Kanawha are not responsible for serious stream pollution.

In the Potomac Basin the largest tannery in eastern West Virginia has committed itself to construction of a new and larger waste-treatment plant. A number of other industries in the basin have agreed to set up laboratory facilities to study waste treatment problems.

Results from industrial cooperation in the Ohio Basin have been equally encouraging. All major industries have agreed to set up laboratories to delineate their pollution problems. By-product coke plants on tributaries of the Ohio River now operate phenol-recovery units to preclude pollution from this source. Two large industries in the Parkersburg area (E. I. du Pont de Nemours and Co. and the American Cyanamid Co.) are constructing adequate treatment units. Both of these companies in consultation with state officials have committed themselves to large expenditures to avoid stream pollution.

Municipalities make plans

Assistance to municipalities in determining the best solution of sewage treatment problems comprises the

third part of the commission's program. Frequent conferences in cooperation with the State Department of Health are being held with officials of various cities. Many of these municipalities have announced plans for projects that will reduce greatly pollution in West Virginia's streams.

Plans are in preparation

Results of this phase have been good. Although treatment facilities now are provided for only slightly more than ten percent of the sewered population of West Virginia, plans are being prepared to provide 53 percent of this group with treatment facilities. Four cities—Beckley, Romney, Bluefield and Spencer—have already completed new plants. Numerous other cities are preparing plans for treatment facilities, including Clarksburg. Plans for Charleston's plant were 60 percent complete in Jan., 1947. Both cities may begin construction soon.

Municipalities with well-advanced plans for new or additional facilities include: Wheeling, Parkersburg, Huntington, Martinsburg, Welch and Logan. Moreover, a number of smaller cities are going ahead rapidly with plans that will result in construction this year. The map reproduced as Fig. 1 shows the cities that have treatment facilities, that are now preparing plans for plants, that are doing preliminary planning, and that need treatment facilities but have taken no definite action.

Cities without plants and having done little to change this condition are in the minority. Moreover, officials of many of these cities have been contacted by representatives of the West Virginia Water Commission or the State Health Department. These meetings have indicated that several of the lagging communities are expected to take action this year. It is felt that the commission will not need to use its authority to force cities to construct treatment facilities. Instead, cooperative work is expected to bring about the desired results.

The degree of treatment is decided by the commission and the state health officials. In general, the least requirement is sufficient treatment in the case of "C" and "B" Zones to allow the stream to recover to the next higher zone. In the "A" Zone, only enough treatment will be necessary to prevent the stream from becoming more seriously polluted. No treatment will be required by industries and municipalities tributary to "AA" Zones, except where the stream enters a trend of destruction.

Exceptions, of course, will require more treatment than specified in these generalities. Where contributed wastes are creating critical stream conditions, industries and municipalities will be urged to undertake abatement measures, even though a zone has not been established for these sections.

Useful data are supplied

The commission also aids industries in expanding existing facilities or in constructing new factories in West Virginia. Data are supplied on the quality of water available in neighboring streams and on the standard of treatment required for the new plant. Here again a spirit of cooperation is offered; the results have been most encouraging.

For the West Virginia Water Commission, Kenneth S. Watson is engineer; John W. Lester, assistant engineer; and Arch A. MacQueen, chemist. The headquarter's office of the commission is at Charleston.

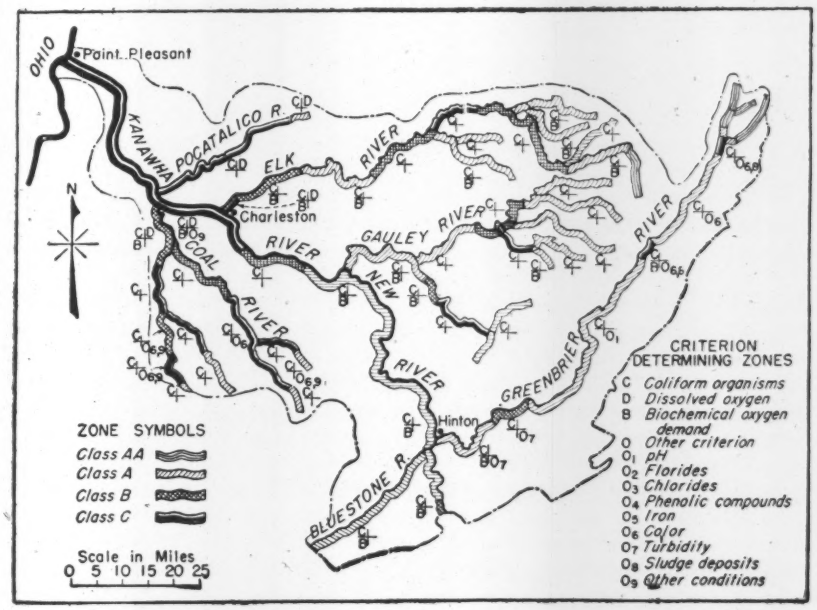


Fig. 2. Major streams in the Kanawha River basin have been zoned. Symbols indicate water deficiencies at respective locations.

Clean Stream Program Produces Results

Up to the present time Pennsylvania's stream clearance program, launched in 1945, has resulted in 553 municipalities, industries and institutions receiving notification to prepare plans for sewage treatment works. In addition, 430 industries have been notified to prepare plans for industrial waste treatment.

The Sanitary Water Board, it is announced, has received applications from 154 anthracite coal operators for approval of silt removal systems and installations which will keep 26,500 tons of silt daily from the Schuylkill and Susquehanna rivers.

More than 1600 reports have been received from bituminous coal mine operators showing the sources of mine drainage.

The operators reporting represent 95 percent of the state's total bituminous production.

Mine sealing was begun last summer and a number of surveys have been made along tributaries to streams which are highly important to recreational and fishing areas. Some surveys reveal that sealing openings of abandoned mines was not practical because of active mine openings leading into the abandoned shafts. Others have resulted in definite sealing programs.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Engineers as Corporation Heads

Sir: When the directors of a corporation are faced with the problem of selecting a new president, he will be chosen not alone because of his demonstrated ability in his own chosen field of activity but more largely because of his breadth of interest and his understanding of the problems of other departments. Whatever the corporation, it will have vice-presidents or otherwise-designated heads of its activities in the fields of: operations or production, finance and accounting, engineering, industrial and public relations, sales and advertising, and legal affairs. Assuming that one will be chosen who best understands the inter-relation of all these activities in the successful conduct of the business. He will have breadth of interest beyond his own specialty.

Such breadth of interest will be due only in small measure to a man's collegiate training, there must be progressive development throughout his life; but the breadth of his academic training and the stimulation which it gives him in post-collegiate development is the important factor in his ultimate success as executive.

We hear so much loose talk about engineers being narrow in their training and their interests that I decided to get the facts as shown by the academic backgrounds of the presidents of large American corporations. With the valued assistance of Miss Helen Converse, engineering librarian, we have been compiling this information. We tried to get a general cross-section of American corporations, especially those which were large employers of labor or had vital problems of labor or public relations. We therefore included the railroads, the producers of steel, aluminum and copper, coal and oil, the major chemical industries, and the automotive industries, a wide variety of manufacturing, including textiles, electric machinery, agricultural implements, machine tools, tobacco, furniture, etc. We also included the chain stores, mail order houses and many of the department stores in our principal cities. We scrupulously tried to avoid any unfair packing of the list with industries which were essentially engineering in nature. To date we have tabulated the desired information on 150 corporations. This seems to be a large enough sample to warrant some general conclusions although, admittedly, when the cross-section is enlarged to 300 or 500 there may be some slight changes in the percentages.

EDUCATIONAL BACKGROUND OF 150 CORPORATION PRESIDENTS

Type of Training	Number	Percent
Engineering	50	33.3
Liberal arts and teachers colleges	45	30.0
Common school education	16	10.7
High school education	13	8.7
Lawyers	11	7.3
University or college graduates in business administration or commerce	6	4.0
Graduates of commercial business colleges	5	3.3
Graduates in pure science (All were chemists)	4	2.7
Totals	150	100.0

A further analysis shows the types of engineering in which 37 of the 50 engineers were trained, as follows: Mechanical, 14; civil 7; electrical 4; chemical, 4; mining, 3; metallurgical, 2; naval architectural and marine engineering, 2; aeronautical, 1; and not specified, 13.

The proportion of engineers has greatly increased in recent years. A few years ago it was 20 percent. This is a responsibility that we must recognize to make more of our engineers capable of becoming corporation presidents and of an even higher type than we have today, for the social responsibilities of corporation executives are constantly increasing. But I submit that there is an equal responsibility on the schools that produced the other 66.7 percent. I wish there were some basis for classifying the presidents to determine whch types were the best, but we may well assume that the relative numbers tell something on that score.

If breadth of interest and capacity is the accepted criterion in the selection of corporation presidents, and if 160 engineering colleges have produced more corporation presidents than 1,600 liberal arts and teachers colleges, one may well ask—which type of college gives the broadest training or stimulates to broadest post-collegiate development?

EARLE B. NORRIS
Dean, School of Engineering, Virginia Polytechnic Institute
Blacksburg, Va.

Toll Roads Favored

Sir: A state highway official recently and pointedly called my attention to the news item in *Engineering News-Record*, April 24, vol. p. 712, entitled "Perspective. . . . Controversy over Toll Roads". This statement had not escaped attention, but comment was delayed by other urgent matters and uncertainty that comment was necessary. Apparently comment is advisable in order that more facts may be available, rather than prejudice and selfish opposition alone, and so that we might avoid "Lack of Perspective".

The attitude of the Public Roads Administration toward toll roads and toll bridges has long been known and repeatedly presented. The attitude of certain non-government highway groups has also long been known, with reasons not entirely unselfish. Such private organizations are not fundamentally altruistic and are not opposed to getting "something for nothing".

There is no fundamental difference between a publicly owned toll road or tunnel and a publicly owned toll bridge when each is constructed to meet critical conditions in critical areas where no other basis for securing financial support is available. It is certainly wiser to secure promptly a badly needed public improvement on the basis that "the user pays" and to have prompt and full usage of this improvement while it is paying for itself and becoming free from tolls, than it is to defer such an improvement for many years or indefinitely until it can be built as a "free" improvement. In fact there is no such thing as a "free" project. Any improvement must be built, maintained and paid for one way or another, usually through some form of general

taxation. A toll project is simply based on the most equitable and direct form of taxation, "the user pays". The non-user is not burdened.

As outstanding examples of publicly owned toll projects, we have the Pennsylvania Turnpike, Henry Hudson Parkway, Marine Parkway, Merritt Parkway, Wilbur Cross Parkway, Maine Turnpike (under construction), George Washington Bridge, Holland Tunnel, Lincoln Tunnel, Sumner Tunnel, Triborough Bridge, Whitestone Bridge, Philadelphia-Camden Bridge, Golden Gate Bridge, San Francisco-Oakland Bay Bridge, and many bridges over the Mississippi River and over other large rivers and waterways. There are other and many notable examples. None of these could possibly have been built and put in use when they were except as toll projects. Was it a mistake to construct these monumental and useful engineering projects? Should they have been delayed until they could be built as "free" improvements? The tremendous volume of usage provides the best answer.

In simple terms:

No one wants a toll project for public transportation if a so-called "free" project is promptly feasible.

There is no real difference as publicly-owned toll projects between toll bridges, toll tunnels, toll roads or toll ferries.

No toll project is possible which is not economically justified by qualified engineering and financial studies.

A toll project is designed primarily to meet critical conditions in critical areas and where excessive costs of construction place excessive burdens upon our normal arrangements for public financing through general taxes.

A toll project permits prompt construction and permits its usage while its cost is beng met as the "user pays".

A toll project should be made "free" as soon as the construction cost has been liquidated by toll collections.

Many of our most notable toll projects are being and have been financed without federal or state financial aid, leaving the normal highway funds available for normal highway programs.

Speed of engineering and construction is attainable on toll projects which is almost never attainable in normal highway programs, particularly where federal aid and restrictions are involved.

Toll projects must be constructed as complete projects, or as complete units of major programs, and with maximum speed to avoid excessive interest charges during construction. The usual major highway program requires piecemeal construction over a period of years, because of politics or lack of finances, or both.

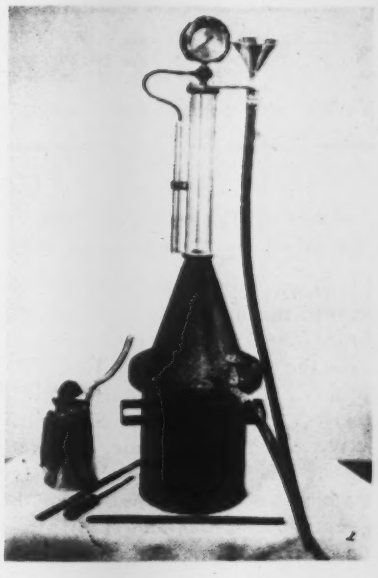
The charge of excessive costs of construction against toll roads, or other toll projects, is not true, all factors considered. Under proper administration and design, the costs should be identical in either case, except for nominal cost of toll collection devices. For example, a superhighway merely supplements highways for local traffic. Crossing or conflicting lines of traffic must be avoided for safety purposes and points of access and departure must be controlled and strategically located, with adequate grade separation facilities. Interchanges on toll roads are merely a part of these arrangements. Proper grade separations or interchanges on free superhighways should be equivalent to those on toll superhighways, if a true superhighway is to be provided. The economies in both cases should be comparable and actually equivalent.

In conclusion, why stop or defeat needed public improvements and engineering progress simply because of an argument over the form of taxation by which such improvements are made possible? What is unfair or inequitable about requiring the user of an improvement to pay directly for its usage if no other basis for providing this improvement exists? Why not go forward with the building up of our country and the provision of badly needed improvements for the use of our people through all of the methods of taxation which are available to us, direct as well as indirect?

E. R. NEEDLES
Howard, Needles, Tammen & Bergendoff, Consulting Engineers, New York

Air Entrained in Concrete

Sir: With reference to your report on the paper delivered at the recent meeting of the American Concrete Institute in Cincinnati by Carl A. Menzel, Portland Cement Association,



Device for measuring entrained air.

on the development of apparatus for measuring the volume of air entrained in concrete (*ENR* Apr. 3, vol. p. 505), it is our understanding that the Klein-Walker air meter was developed by W. H. Klein, vice president of the Penn-Dixie Cement Co., and Stanton Walker, chief engineer of the National Ready-Mix Concrete Association, according to the June 1946 issue of the ACI *Journal*.

Also, we made what we believe to be the first meter used and were given credit for this. For some time we have been manufacturing these air meters in both the $\frac{1}{2}$ and $\frac{1}{3}$-cu. ft. sizes and have a large number in use.

These meters are of light-weight, but of strong welded construction, especially suited for field use. They are graduated directly in percentage of air, and it is only necessary to fill the meter with fresh concrete and water, apply a small pressure obtained from a chart and read the air content on a graduated plastic tube.

C. A. HOGENTOGLER, JR.,
Hogentogler and Company, Chevy Chase, Md.

In presenting his paper at the ACI meeting, Mr. Menzel pointed out that the pressure method was first proposed by Klein and Walker, but that certain modifications in the apparatus and procedure were necessary to make the method practical and dependable under various conditions to be found on the job—EDITORS.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Leak in Prestressed Tank Located by Compressed Air

Leakage around the rubber filler between the floor slab and wall of a 3,000,000-gal. prestressed concrete tank, the Joaquin Miller Reservoir, on the East Bay Municipal Utility District's system was located recently by use of compressed air. Construction of this type of tank, some ten of which have been installed for the system serving Oakland, Calif., and other nearby cities, was described in *ENR* March 13, 1941, vol. p. 419. Five more are now under construction.

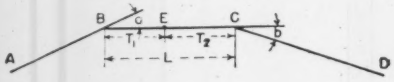
A rubber filler in the space left between the floor slab and the wall serves to make the tanks bottletight. Drains to prevent water from undermining the wall footings are placed in gravel just inside these footings. In such a location they serve to lead off any leakage which may come through the wall and floor slab joint as well as other water under the slab.

Tanks of this type have been in service in the East Bay system since 1934 and leakage has not been a problem. However, when leakage on the Joaquin Miller Reservoir reached 25 gpm. as measured in one of the several pipes leading from the drain, district officials decided to investigate. The tank was emptied until only 3 or 4 in. of water was standing in it and a compressed air supply was connected to the drain in question. Air bubbling around the rubber filler showed the location of the leak. Then by tightening the nuts on the studs which hold the filler in place, the leak was effectively sealed by the expansion of the rubber.

Radius Computed for Curve Tangent to Three Lines

A problem in horizontal curves that occurs frequently on state examinations for engineers is one in which three lines AB, BC and CD, the deflection angles between them (all in the same direction), and the length L of line BC are given and it is required to find a simple circular curve of radius R tangent to the three lines.

To solve this problem, assume that the single, simple circular curve is made up of two simple circular curves



of equal radius and that point E on BC is the point of tangency on that line. Hence E will also serve as the P. T. of the curve going from AB to BC and the P. C. of the curve going from BC to CD. Let T_1 be the tangent distance of curve AB to BC, T_2 the tangent distance of curve BC to CD, a the intersection angle for curve AB to BC and b the intersection angle for curve BC to CD.

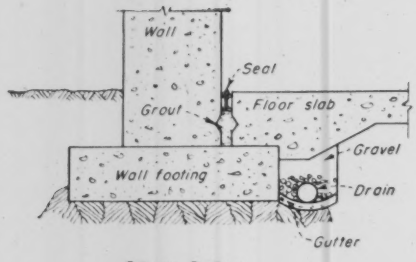
According to the geometry of the simple curve, $T = R \tan \frac{1}{2} I$, where I is the intersection angle. From the accompanying figure, $T_1 + T_2 = L$; $T_1 = R \tan \frac{1}{2} a$; and $T_2 = R \tan \frac{1}{2} b$. Since the radii of the two curves are equal, $T_1/\tan \frac{1}{2} a = T_2/\tan \frac{1}{2} b$. Substituting $L - T_1$ for T_2 gives $T_1/(L - T_1) = \tan \frac{1}{2} a/\tan \frac{1}{2} b$, which can be solved for T_1. Substitute in the equation $R = T_1/\tan \frac{1}{2} a$ to find the radius required.—Lester H. Weinberg, *Instructor in Civil Engineering, University of Akron, Akron, Ohio.*

Oil Pumped Under Steel Tank To Prevent Corrosion

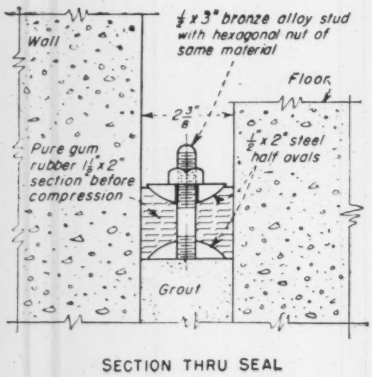
In an effort to prevent possible corrosion on the underside of the bottom plate of steel water tanks, officials of the East Bay Municipal Utility District in California have adopted a system of pumping low grade oil under the tank. Although small samples cut from the bottom plates have given no indications of trouble, reports of tank failures elsewhere due to such corrosion have prompted district officials to adopt such a system. The tanks in question are of capacities up to 200,000 gal. and are placed on a sand cushion which is held in place by a reinforced concrete ring.

To provide means of access for the oil, a ¾-in. welded tap is made at the center of the tank bottom. Then some 40 to 75 gal. of low grade oil (district officials say that any low viscosity oil can be used) is pumped through the tap into the sand cushion under the tank bottom by means of a hand pump. Enough oil is forced in until the tank bottom raises slightly in the center.

The addition of a load of water in the tank is expected to force the oil from a location relatively near the center of the tank out to the side of the tank, thus coating the entire bottom with a film of oil. A regular program of such a protective measure is contemplated.



DRAIN DETAIL


½ x 3" bronze alloy stud with hexagonal nut of same material
Wall
Floor
2 3/8"
Pure gum rubber 1½ x 2" section before compression
½ x 2" steel half ovals
Grout

SECTION THRU SEAL

Fig. 1. Details of the wall and floor joint indicates how the rubber filler serves to prevent leaks in these large tanks.

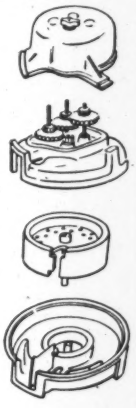
Why . . .

THE **MOST** METER COSTS THE **LEAST**

Even when Empire meters sold for a high premium over ordinary meters, they were still the least expensive you could buy. And at today's comparative prices they are the biggest meter bargain ever offered.

When you figure the cost of removing, repairing and replacing a stopped meter . . . when you figure the revenue loss on meters that register less and less as time goes on . . . then it becomes apparent that overall cost should be your chief consideration when buying meters.

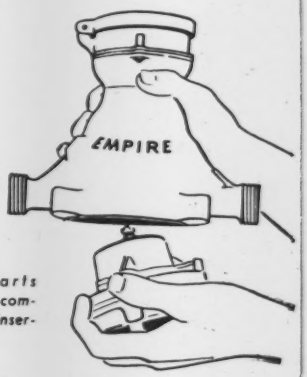
Empire meters, with their balanced oscillating piston principle, cost least in the long run. And this statement is backed by hundreds of water works men who have had ten, twenty, even thirty years of Empire metering experience.



Simple construction, interchangeability, few working parts.

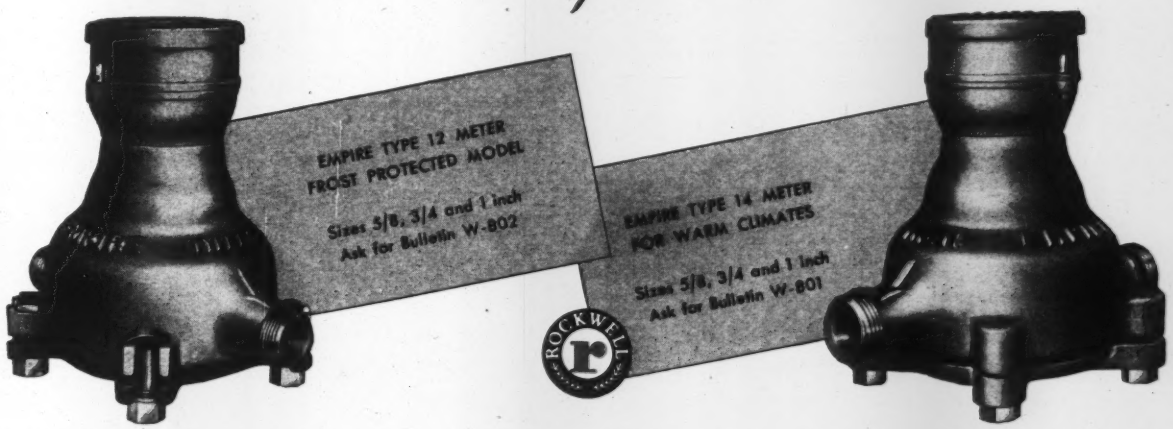
COSTS LESS TO REPAIR, TOO

Here is the simple arrangement of component parts of the working mechanism in Empire Type 12 and Type 14 meters. Speedy dismantling and assembly; fewer parts, exactingly interchangeable parts, all combine to make short work of meter shop operations. There are only three interior castings. They assemble without the use of screws. Fitting is quick, positive. The assembled measuring unit can be pre-tested for its free running qualities prior to being bolted in the meter case.



Working parts assemble as a complete unit for insertion in case.

EMPIRE *Oscillating Piston* METERS



PITTSBURGH EQUITABLE METER DIVISION

Rockwell Manufacturing Company....Pittsburgh 8, Pennsylvania

Atlanta, Boston, Chicago, Houston, Kansas City, Los Angeles, New York
Pittsburgh, San Francisco, Seattle, Tulsa

UNIT PRICES BID BY CONTRACTORS

Interceptor Sewer, Dallas, Texas

OWNER: City of Dallas.

PROJECT: Construction of an interceptor sewer from Cadiz St. to Inwood Rd. along Trinity River bottom in Dallas, Texas. Sewer to be 6′ to 7′6″ in diameter and varying in depth up to 25′.

CONDITIONS: All materials to be furnished by the contractor. Access to job site is by both rail and highway. Allotted time for completion is 270 consecutive calendar days. Specified wage rates are $1.60 per hour for skilled labor; $1.10 per hour for semi-skilled labor; and $.90 per hour for common labor.

BIDS: Five bids were received January 22, 1947, ranging from the contract low of $1,684,152.60 to $2,479,663.40.

LIST OF BIDDERS:

1. P. C. Sorenson Co., Dallas, Texas (contract) $1,684,152.60
2. E. H. Reeder Const. Co., Dallas, Texas 1,772,159.20
3. Dellone Const. Co., Dallas, Texas 1,986,849.00
4. McKenzie Const. Co., San Antonio, Texas 2,377,317.00
5. Oldt-Midwest Co., Dallas, Texas 2,479,663.40

	Item	Quantity	Unit Price (1)	Unit Price (2)
1	Mono. sewer, 7′ 6″ diam., type "B", reinf.	2,210 lf	$77.50	$79.00
2	Mono. sewer, 7′ 6″ diam., type "C" reinf.	4,452 lf	79.00	81.00
3	Mono. sewer, 6′ 6″ diam. type "B" reinf.	6,276 lf	65.50	60.00
4	Mono. sewer, 6′ 0″ diam., type "A" reinf.	7,846 lf	36.50	37.50
5	Mono sewer, 6′ 0″ diam., type "B" reinf.	1,203 lf	37.50	43.00
6	Mono. sewer, 54″ diam., (Dallas br. trunk)	1,027 lf	32.00	59.65
7	Mono. sewer, 7′ 6″ diam., in tunnel	1,597 lf	125.00	153.50
8	Mono. sewer, 6′ 0″ diam., in tunnel	135 lf	100.00	133.00
9	Storm drain crossing struct. 59 + 40.42	lump sum	2,150.00	4,700.00
10	Storm drain crossing and transition	lump sum	4,100.00	7,500.00
11	June. struc. with M.H., 0 + 66	lump sum	1,500.00	2,400.00
12	June. struc. with M.H. 8 + 61.33	lump sum	1,320.00	1,950.00
13	June. struc. with M.H. 53 + 01.35	lump sum	1,250.00	1,850.00
14	June. struc. with M.H. 73 + 17.43	lump sum	1,550.00	2,300.00
15	June. struc. with M.H. 89 + 54.65 and 114 + 41	2 ea	700.00	825.00
16	June. struc. with M.H. and transition, 136 + 85	lump sum	1,350.00	900.00
17	June. struc. with M.H. 223 + 31.93	lump sum	600.00	600.00
18	June. struc. with M.H. on 51″ no. interceptor	lump sum	3,360.00	3,650.00
19	Sub-base and sub-drain for 7′ 6″ sewer	7,368 lf	2.10	3.30
20	Sub-base and sub-drain for 6′ 6″ sewer	6,305 lf	2.00	1.00
21	Sub-base and sub-drain for 6′ 0″ sewer	9,184 lf	1.70	1.00
22	Sub-base and sub-drain for 54″ sewer	1,027 lf	1.50	2.80
23	Timber piles, 10′, for 7′ 6″ sewer	204 lf	37.50	33.20
24	Timber piles, 15′, for 7′ 6″ sewer	174 lf	44.00	36.30
25	Timber piles, 20′, for 7′ 6″ sewer	282 lf	40.00	40.00
26	Timber piles, 25′, for 7′ 6″ sewer	216 lf	42.00	41.00
27	Timber piles, 30′, for 7′ 6″ sewer	156 lf	45.00	43.80
28	Timber piles, 10′ for 6′ 6″ sewer	48 lf	30.00	32.20
29	Timber piles, 15′, for 6′ 6″ sewer	104 lf	35.00	35.30
30	Timber piles, 20′, for 6′ 6″ sewer	472 lf	32.00	39.00
31	Timber piles, 25′, for 6′ 6″ sewer	240 lf	33.00	40.00
32	Timber piles, 30′, for 6′ 6″ sewer	96 lf	35.00	41.80
33	Type "M" M.H.s on 7′ 6″ mono. sewer	2 ea	850.00	1,000.00
34	Type "M" M.H.s on 6′ 6″ mono. sewer	2 ea	675.00	250.00
35	Type "M" M.H.s on 6′ 0″ mono. sewer	1 ea	575.00	200.00
36	Type "N" M.H.s on 54″ mono. sewer	2 ea	375.00	400.00
37	Box culvert sta. 134 + 93	lump sum	2,100.00	2,000.00
38	Ventilation str. and air conductor pipe	2 ea	860.00	1,000.00
39	Bulkhead in 7′ 6″ sewer	lump sum	100.00	150.00
40	Bulkhead in 6′ 0″ sewer	lump sum	75.00	120.00
41	Chimney pipe inlets on mono. sewers	34 ea	75.00	115.00
42	Protective coating on mono. sewers	318,000 sf	0.06	0.08
43	Union terminal turn track trestle	lump sum	5,000.00	5,000.00
44	Ex. strength reinf. conc. pipe—48″	62 lf	58.00	70.00
45	Ex. strength reinf. conc. pipe Pacific—30″	843 lf	19.00	30.00
46	Ex. strength reinf. conc. pipe Ced. Spgs—30″	2,665 lf	10.20	14.00
47	Std. strength reinf. conc. pipe Knights Br—27″	2,963 lf	9.00	13.25
48	Type "O" MH, Pacific Ave. trunk	3 ea	420.00	550.00
49	Type "O" MH, Cedar Spgs. trunk	7 ea	360.00	250.00
50	Type "O" MH, Knight's Br. trunk	8 ea	330.00	225.00
51	Class "C" concrete backfill	800 cy	15.00	15.00
52	Gravel backfill	3,200 cy	6.00	5.50
53	Class "C" conc. pipe cradle	430 cy	15.00	15.00
54	Cutting and replacing 9–6–9 conc. paving	450 sy	5.00	4.00
55	Cutting and replacing 7–6–7 conc. paving	295 sy	5.00	4.00
56	Cutting and replacing 1½″ sur. and 12″ rock base	320 sy	4.50	5.00
57	Cutting and replacing 2½″ sur. and 10″ rock base	54 sy	5.50	5.00
58	Cutting and replacing penet. pav. and 6″ gr. base	308 sy	3.00	3.00
59	Cutting and replacing 7′ conc. laydown dr	40 sy	5.00	5.00
60	Cutting and replacing conc. curb and gutter	90 lf	2.60	3.00
61	Storm drain inlet and connection	lump sum	300.00	300.00

Tully Dam, Royalston, Massachusetts

OWNER: U. S. Engineers, Boston, Massachusetts.

PROJECT: Construction of earth dam and appurtenant structures consisting of (a) the construction of a concrete lined tunnel and outlet channel, intake structure and intake channel, intake structure superstructure, and furnishing and installing all gates and equipment; (b) construction of an earth dam by the rolled fill method with an impervious core and upstream blanket, and random and pervious outer shells with dumped rock fill slopes; (c) construction of concrete spillway weir and training wall, including excavation of spillway approach channel and spillway chute; (d) construction of concrete arch bridge and a portion of relocated highway, culverts, gravel drives, gravel walks and gravel parking areas; (e) construction of utility building-field office, utilities and general landscaping work.

CONDITIONS: Contract time is 550 calendar days. Access to job site is by railroad and highway. Minimum wage rates specified are: bricklayers, $1.995 per hour; carpenters, $1.25; electricians, $1.50; ironworkers, structural, ornamental, reinforcing, $1.85; painters, brush, $1.25; painters, spray, $1.50; steamfitters, $1.50; operators of air-compressors (315 cu. ft. and over), $1.40; of bulldozers, $1.50; of hoists (3 or more drums), $1.90; and unskilled laborers, $1.05.

BIDS: Eight bids were received, ranging from the contract low of $762,545.00, awarded March 13, 1947, to $1,138,596.00.

LIST OF BIDDERS:

1. Kelleher Corp., Turners Falls, Mass. $762,545.00
2. Campanella & Cardi Const. Co., Hillsgrove, R. I. 830,289.50
3. Daniel O'Connell's Sons, Inc., Holyoke, Mass. 896,692.15
4. Carlo Bianchi & Co., Inc., Farmingham, Mass. 952,547.50
5. M. De Matteo Const. Co., Quincy, Mass. 964,810.75
6. The Savin Const. Co., Inc., East Hartford, Conn. 1,021,290.00
7. Geo. M. Brewster & Son, Inc., Bogota, N. J. 1,098,143.50
8. B. Perini & Sons, Inc., Farmingham, Mass. 1,138,596.00

	Item	Quantity	Government Estimate	Unit Prices (1)	Unit Prices (2)
1	Diversion and care of river	lump sum	$15,000.00	$20,000.00	$15,000.00
2	Clearing and grubbing	lump sum	15,000.00	20,000.00	29,500.00
3	Common stripping	10,000 cy	.60	.60	1.00
4	Common excavation—general	135,000 cy	.50	.45	.60
5	Common excav.—highway grading	4,300 cy	.60	.70	1.00
6	Common excav.—borrow, area "A"	31,000 cy	.65	.50	.45
7	Common excav.—borrow area "C"	28,000 cy	.65	.50	.45
8	Common excav.—borrow area "D"	16,300 cy	.75	.65	.50
9	Common excavation—trench	1,100 cy	1.50	3.00	2.00
10	Rock excavation—open cut	69,000 cy	2.50	1.60	2.75
11	Mucking of overbreak material in open cut	3,000 cy	.40	.40	.40
12	Line drilling and broaching	12,000 sf	1.50	1.50	.50
13	Rock excavation—tunnel	600 cy	20.00	25.00	35.00
14	Mucking of overbreak material in tunnel	30 cy	3.00	3.00	3.00
15	Tunnel protection	50 lf	25.00	25.00	50.00
16	Dry packing	20 cy	12.00	20.00	50.00
17	Impervious fill	52,000 cy	.25	.15	.20
18	Random fill	36,000 cy	.22	.15	.15
19	Pervious fill	11,500 cy	.20	.15	.15
20	Gravel bedding	20,000 cy	.60	.70	.25
21	Compacted backfill	2,200 cy	1.25	1.00	1.00
22	Filter gravel	50 cy	5.00	3.00	12.00
23	Gravel for roads	3,800 cy	1.25	1.20	1.50
24	Dumped rock-fill	65,000 cy	.50	.80	1.00
25	Hand-placed riprap	600 cy	7.00	5.00	10.00
26	Grouted riprap	1,800 sy	5.50	4.50	10.00
27	Stone gutters	500 sy	2.25	3.00	6.00
28	Gravel filled drains	220 lf	1.25	4.00	3.00
29	Corrugated metal pipe, 10-inch	80 lf	2.00	3.00	2.00
30	Core drilling	360 lf	6.00	8.00	10.00
31	Ordinary drilling	1,100 lf	1.50	1.50	2.00
32	Pressure grouting	2,000 cf	2.00	4.00	3.00

Continued on next page

Tully Dam, Royalston, Massachusetts

Continued from preceding page

33	Portland cement	5,000 bbl	3.40	3.25	3.50
34	Steel reinforcement	108,000 lb	.09	.08	.12
35	Concrete—tunnel lining	280 cy	35.00	37.00	35.00
36	Concrete—intake structure and downstream portal	610 cy	38.00	33.00	30.00
37	Concrete—road, bridge structures	660 cy	40.00	42.00	23.00
38	Concrete—spillway weir and miscellaneous structures	2,000 cy	18.00	27.00	20.00
39	Concrete backfill	50 cy	7.00	7.00	7.00
40	Intake structure superstructure	lump sum	12,000.00	20,000.00	17,500.00
41	Miscellaneous structural steel	15,000 lb	.20	.30	.25
42	Miscellaneous iron and steel	2,900 lb	.25	.35	.50
43	Miscellaneous wrought iron pipe	1,400 lb	.50	.40	1.00
44	Miscellaneous black steel pipe	1,400 lb	.35	.35	.90
45	Miscellaneous brass and bronze	200 lb	1.00	1.50	2.00
46	Copper water stops	2,000 lb	.80	1.50	1.50
47	Electric light and power system	lump sum	6,000.00	18,000.00	16,640.00
48	Exterior electrical work	lump sum	2,800.00	6,000.00	16,880.00
49	Gates and accessories	lump sum	45,000.00	65,000.00	29,500.00
50	Traveling crane	lump sum	5,000.00	10,000.00	7,362.00
51	Gasoline-electric standby unit	lump sum	5,500.00	4,000.00	3,075.00
52	Utility building—field office	lump sum	17,500.00	28,000.00	22,500.00
53	Water level recorder and accessories	lump sum	500.00	2,000.00	1,000.00
54	Flag pole and base	lump sum	500.00	1,000.00	300.00
55	Highway guard railing	3,600 lf	1.80	2.50	2.30
56	Guard fencing	2,600 lf	.60	1.25	.97
57	Bituminous material	23,000 gal	.18	.16	.13
58	Bituminous macadam road surface	10,000 sy	1.40	1.00	1.40
59	Tile gages	lump sum	300.00	1,500.00	1,500.00
60	Drilling and casing well	15 lf	20.00	20.00	30.00
61	Well-pump and accessories	lump sum	1,500.00	2,000.00	2,000.00
62	Brick manholes	2 ea	175.00	200.00	160.00
63	Galv. w. i. water pipe fittings, 2-in.	360 lf	1.00	1.50	1.20
64	Galv. w i. water pipe fittings, 2½-in.	1,000 lf	1.40	2.00	1.50
65	Septic tank	lump sum	225.00	1,500.00	1,500.00
66	Vitri. clay pipe, 4-in. open joints	400 lf	.30	1.00	1.50
67	Vitri. clay pipe, 4-in. mortar joints	60 lf	.40	1.25	1.50
68	Vitri. clay pipe, 6-in. open joints	160 lf	.45	1.25	1.60
69	Vitri. clay pipe, 6-in. mortar joints	750 lf	.60	1.50	1.60
70	Perf vitr clay pipe, 6-in mortar joints	75 lf	.80	2.00	2.00
71	Topsoil	2,100 cy	1.00	1.50	1.50
72	Fertilising and seeding	4 ac	400.00	300.00	800.00
73	Chain link fence	45 lf	3.00	4.00	3.50
74	Settlement gages	lump sum	2,500.00	2,000.00	2,000.00
75	Maintenance of highway traffic	lump sum	3,000.00	5,000.00	10,000.00

Macadam Surfaced Road, Pa.

OWNER: State Highway Department, Harrisburg, Pennsylvania; E. L. Schmidt, Chief Engineer.

PROJECT: Improvement of 8.24 miles of highway on routes 370 and 247 in Wayne County, Pennsylvania. Road to be surfaced with macadam pavement. The channel of Shehawken Creek will be changed at several places to protect the highway. Construction of one new concrete bridge with span of 34 ft. and 32 ft. wide.

CONDITIONS: All materials to be furnished by contractor. Contract time is 125 working days. Access to job is available by rail and highway. Skilled wage rate is $1.50 per hr.; semi-skilled, $1.25 per hr.; and common, $.90 per hr.

BIDS: Two bids were received, the contract low of $760,937.70 and $781,833.66. Contract was awarded April 10, 1947.

LIST OF BIDDERS:

1. A. W. Hinaman and John Kaminski, Williamsport, Pa. (contract) $760,937.70
2. Collins and Maxwell, Easton, Pa. 781,833.66

	Item	Quantity	Unit Prices (1)	Unit Prices (2)
1	Clearing and grubbing	lump sum	$15,000.00	$20,000.00
2	Excav.—Cl. 1	149,019 cy	1.10	1.20
3	Excav.—Cl. 2	6,247 cy	5.00	4.00
4	Borrow excav	1,707 cy	1.10	.50
6	Subgrade	105,600 sy	.30	.22
8	Shoulders	45,220 lf	.30	.25
9	Sub-base	500 cy	8.00	4.50
11	Nat. stone, type "A" or cr. agg. bs. crse. 10" deep	99,731 sy	2.50	2.71
12	Nat. stone, type "B" or cr. agg. bs. crse. 8" deep	7,369 sy	2.00	2.10
17	Calcium chloride	3 tons	60.00	50.00
23	Plain cmt. concr. wear. surf. for bldg. floor	136 sy	4.00	4.00
27	Bit. surf. crse., DP-1, 3" deep	103,375 sy	1.25	1.25
28	Concrete—Cl. "A"	75 cy	50.00	45.00
28a	Concrete—Cl. "AA"	4 cy	110.00	100.00
29	Concrete—Cl. "B"	507 cy	45.00	40.00
30	Plain steel bars	32,670 lb	.10	.10
35	Stone backfill for struct.	102 cy	8.00	4.00
35a	Stone backfill for misc. drainage	3 cy	4.00	5.00
42	Cmt. rubble masonry	202 cy	25.00	35.00
53	Grouted rubble pav. for stream beds	186 cy	18.00	35.00
56	Inlets—type "H"	7 ea.	250.00	200.00
56a	Inlets—type "E"	2 ea	150.00	175.00
61	Corr. metal pipe, 18"	50 lf	4.00	4.50
62	Asph. coat. corr. metal pipe, 15"	56 lf	4.00	4.50
62a	Asph. coat. corr. metal pipe, 18"	226 lf	4.50	5.00
62b	Asph. coat. corr. metal pipe, 30"	182 lf	11.00	10.00
62c	Asph. coat. corr. metal pipe, 36"	270 lf	15.00	15.00
62d	Asph. coat. corr. metal pipe, 48"	160 lf	20.00	21.00
65	Reinf. cmt. concr. pipe, 15"	3,452 lf	4.75	4.00
65a	Reinf. cmt. concr. pipe, 18"	1,674 lf	5.00	4.75
65b	Reinf. cmt. concr. pipe, 24"	38 lf	8.00	7.50
65c	Reinf. cmt. concr. pipe, 72"	56 lf	40.00	23.00
67	Corr. metal pipe, relaid, 12"	36 lf	1.50	2.00
67a	Corr. metal pipe, relaid, 15"	316 lf	2.00	3.00
67b	Corr. metal pipe, relaid, 18"	18 lf	2.20	3.50
68	Stone fdtn. under drain, type "B"	300 lf	1.40	.80
69	Tile, 6", under drain, type I backfill	1,125 lf	1.40	1.60
69a	Tile, 6", under drain, type II backfill	5,273 lf	1.35	1.60
70	Tile, 6", fdtn. under drain, type "B"	110 lf	1.35	1.70
71	Tile outlets, 6"	500 lf	1.35	1.30
75	Subgrade drains	6,500 lf	.75	.60
92	Guard fence—1B, 2B, 3B or 4B	2,048 lf	1.15	1.25
92a	Guard fence—1-C	4,976 lf	1.00	1.15
93	Guard posts	126 ea	9.00	5.00
94	End anchorage—type 1, 2, 3 or 4	6 ea	50.00	50.00
94a	End anchorage—type C	31 ea	45.00	50.00

Baltimore Airport Runways, Md.

OWNER: City Aviation Commission, Baltimore, Maryland; C. R. Moore, Executive Director; Whitman, Requardt-Greiner Co. and Associates, Consultants.

PROJECT: Construction of 3 runways and taxiways at the Baltimore Airport in Anne Arundel County, Maryland. Work involves 6,000,000 cu. yds. of excavation; clearing and drainage for 3 runways. One runway is to be 10,000 ft.; the two other runways, 8,000 ft.

CONDITIONS: Material to be moved mostly sand and gravel, no rock. Average haul to be about 2,300 ft. Top soil to be saved and used to cover finished grades. No materials will be furnished by the owner. Access to job site is available by both rail and highway. Stipulated contract time for completion is 300 calendar days. Skilled labor wage rates range from $1.375 to $2.25 per hr., and semi-skilled, from $1.05 to $1.25 per hr. Common wage rates are $.95 per hr.

BIDS: Eleven bids were received ranging from the contract low of $2,063,646.71 to $3,047,997.10. The contract awarded on May 1, 1947, was 28 percent below the engineer's estimate of $2,856,403.00.

LIST OF BIDDERS:

1. Langenfelder and Son, Baltimore, Md. (contract) $2,063,646.71
2. Hooper Construction Co., Montgomery, Ala. 2,372,151.50
3. Ralph Myers Contracting Corp., Salem, Ind. 2,619,274.10
4. Nello L. Teer Co., Durham, N. C. 2,625,059.35
5. Potashnick, O'Dell and Riney 2,647,529.70
6. Harrison Const. Co. and Mashuda Co. 2,742,613.20
7. Davis Const. Corp. 2,760,022.50
8. Groves and Sons, and Bowen and McLaughlin 2,850,690.65
9. Perini and Sons 2,898,263.40
10. McDougald Const. Co. 2,990,578.24
11. Winkelman Co. 3,047,997.10

	Item	Quantity	Engineer's Estimate	Unit Prices (1)	Unit Prices (2)
1	Clearing and grubbing	lump sum	$110,000.00	$86,250.00	$100,000.00
2	Unclassified excav.	5,914,000 cy	0.35	0.25	0.275
3	Concrete	4,500 cy	35.00	30.00	46.00
4	Reinforcing steel	270,000 cy	0.07	0.0725	0.095
5	Rein. concrete pipe*—24"	320 lf	6.35	9.70	6.00
6	Rein. concrete pipe*—27"	476 lf	7.75	11.26	7.25
7	Rein. concrete pipe*—30"	788 lf	9.00	11.07	9.00
8	Rein. concrete pipe*—33"	280 lf	10.75	14.26	12.00
9	Rein. concrete pipe*—36"	1,180 lf	11.40	12.67	12.25
10	Rein. concrete pipe*—42"	2,288 lf	15.15	15.36	14.75
11	Rein. concrete pipe*—48"	1,676 lf	17.30	20.09	20.00
12	Rein. concrete pipe*—54"	1,312 lf	20.40	20.43	21.00
13	Rein. concrete pipe*—60"	1,996 lf	23.75	25.11	25.50
14	Wood flumes, type "A"	1,821 lf	1.00	2.25	3.00
15	Wood flumes, type "B"	525 lf	0.75	2.50	4.50
16	Ditch checks	58 ea	7.50	50.00	30.00
17	Sanitary sewer—10" in place, including manholes	lump sum	7,200.00	8,429.40	9,000.00
18	Soil erosion control	130 a	600.00	442.00	550.00
19	Compaction	4,903,000 cy	0.05	0.018	0.03

* Estimates for reinforced concrete pipe include excavation.

BYERS WROUGHT IRON picked to give this tank greater life expectancy

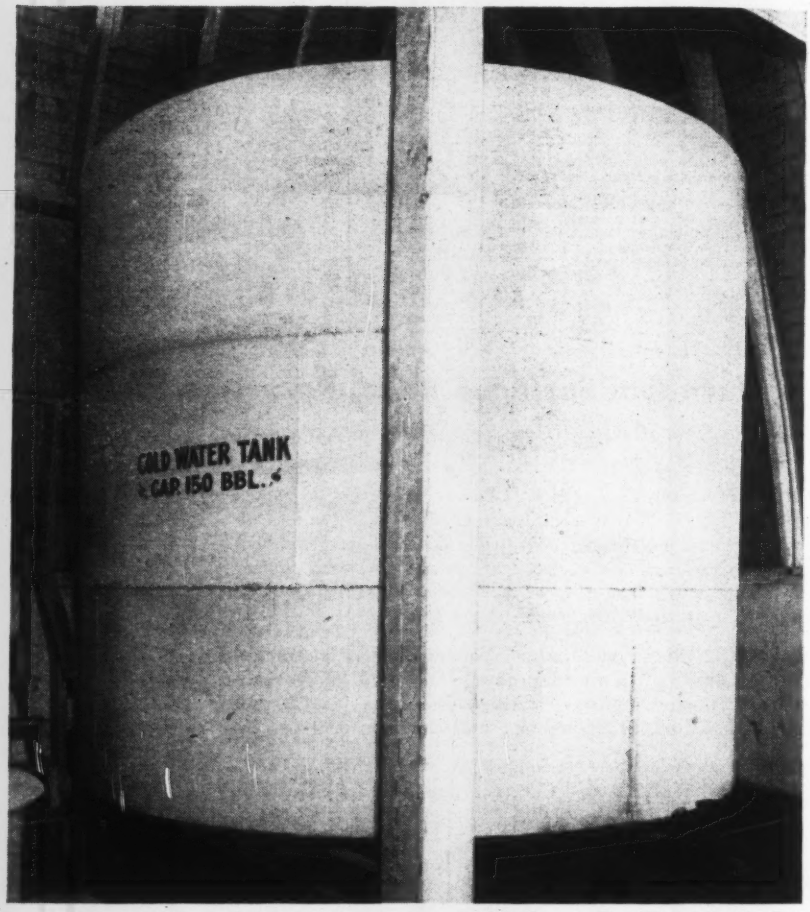
One of the biggest plant maintenance problems is frequently created by the handling and storage of plain, ordinary water. Although it is pure and potable, water can eat vulnerable metals like some corrosive chemical. This problem is aggravated in the case of tanks, where repairs and replacements are difficult and expensive.

The Latrobe Brewing Company, Latrobe, Pa., had such a problem when they recently replaced a large cold water storage tank, located inside the building. The company uses wrought iron in a number of services—cold water, steam supply and return, and brine and ammonia lines—and so had first-hand opportunities to verify its excellent service qualities. The new tank was fabricated from Byers Wrought Iron plates. Welding was done at the site, as due to limited space the tank could not be moved into place complete.

There is ample evidence to support this choice in the many records of wrought iron tanks that have served for forty years and more. In many instances, these tanks were located outdoors, and so exposed to external, as well as internal, corrosive attack. Users report a tank in Ohio, still serving after 47 years; in Mississippi, a tank still serving and in good condition after 42 years; Kentucky, Florida and South Dakota each have tanks that were still on the job after 45 years.

The superior service of wrought iron is not due to surface coatings, but to inherent resistance. Tiny fibers of glass-like silicate slag, threaded through the entire body of high-purity iron, halt and "detour" corrosive attack. They also help to anchor the initial protective scale, which shields the underlying metal.

If your plans include the construction of any new tanks, or the replacement of old tanks that have not given anticipated service, you will find some helpful information in our bulletin, "Wrought Iron for Tank Construction." Ask for a complimentary copy.



A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

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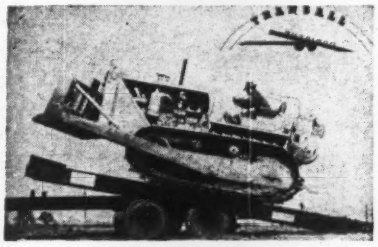
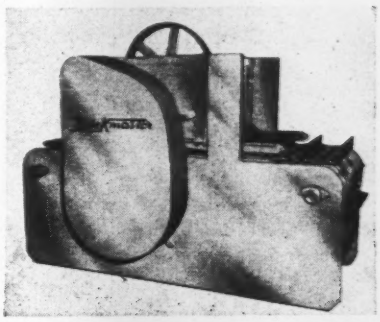
MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

PLATE STEEL PILING—Caine Corr-Plate steel piling is now being rolled from a new high-strength steel alloy. In a series of bending, compression and tensile strength tests, piling made of the new alloy proved to be 25 percent stronger than the same piling made of mild steel. Other tests show the new alloy to have double the corrosion resistance.—*Caine Steel Co., 1820 North Central Ave., Chicago 39, Ill.*



EQUIPMENT MOVING TRAILER—The major advantages of loading and moving equipment on the Wright tilt deck trailer are: safety; ease of loading; one-man operation; and versatility. The 8 x 23 ft. deck of 25 tons capacity makes possible the moving of practically all contractors' equipment. The trailer is ruggedly built for rated capacity. It has no swaying springs but uses rubber cushioned action on specially designed dual axle walking action, eliminating dangerous side sway. Moving is possible under all road conditions. —*Wright Trailer Co., Los Angeles, Calif.*

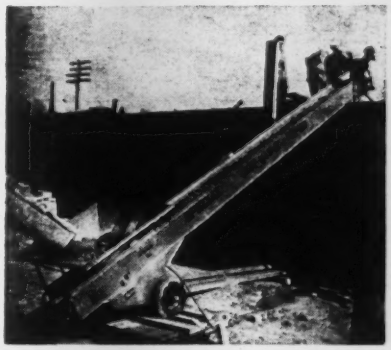
PAVING BREAKER—The Schramm B-80 paving breaker with its unique compact, mechanism is an economical, easy running, hard-hitting tool. It is fully air cushioned and improved in materials and details of design. It is provided with an ample oil chamber to aid in the proper lubrication of parts. High grade special analysis drop forgings are used, carefully machined, heat treated and accurately ground to give this breaker the greatest endurance and reliability.—*Schramm, Inc., West Chester, Pa.*

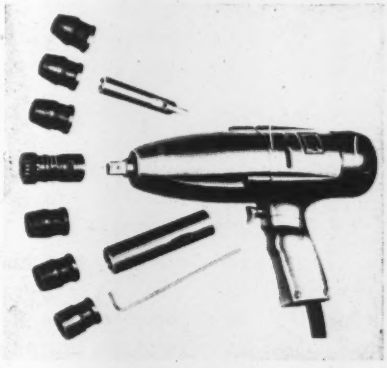


BRICK GENERATING MACHINE—New machine forms bricks six at one time every 3½ sec. on continuous conveyor arrangement at cost of less than $10 per thousand. It will make all standard size bricks in singles or multiples or plain slabs. Many inexpensive local materials may be used, such as slag from foundries, ore, sand, crushed stone, cinders, volcanic ash and other plentiful waste materials. Machine is durably built of welded steel construction with special heavy duty bronze bearings. Weighing 3,600 lb., it is so compact it can be installed in 2 hr., is readily moved about and is adapted to production line of any concrete plant or on construction job. —*Brickmaster, Inc., 115 Broadway, New York 6, N. Y.*

CONCRETE CONVEYOR—Con-Vay-It 12-20 Concrete Special is said to help pour more concrete faster, in about one-fifth the time formerly needed. On large projects these units can be employed in tandem for increased service.

Some of its construction features include: tough textile belt impregnated with 100 percent pure Balta gum; 20 ft. cable; 6-in. take-up; rigid, arc-welded box design frame; adjustable self-scrapers to keep both sides of belt clean; automatic scrapers for head and foot pulleys. The conveyor can be used to handle many building materials.—*American Conveyor Co., 1115 West Adams St., Chicago 7, Ill.*





ALL-PURPOSE ELECTRIC TOOL—An electric hand tool incorporating an entirely new method for increasing the power output of such equipment is being put on the market by the *Ingersoll-Rand Co., 11 Broadway, New York, N. Y.*, through its branch offices and distributors. This tool has a special hammer and spring mechanism on the spindle which permits four interlocking lugs to disengage and rotate a half turn before re-engaging when a predetermined torque has developed on the spindle. This results in a series of sharp impacts in the direction of rotation of the shaft, thus adding to its turning force. At the same time, this mechanism acts as a safety "fuse" to protect the motor from being overloaded due to stalling of the drill or bit. Up until the predetermined torque develops on the spindle, the impact mechanism does not come into play, but as the spindle begins to slow down to the point where the motor would get hot, the impact mechanism acts as a release, letting the motor continue to rotate at a safe speed.

The new tool is designated as size 4-U. It weighs 6½ lb. and is powered with a specially designed reversible 3-amp. electric motor that operates at 110 volts on either AC or DC current. It has a free speed at 2,000 rpm. and delivers 1,900 rotary impacts per minute under load. Using standard attachments, the tool can be used to apply or remove nuts, drill, ream, tap, drive and remove screws and studs, drive wood augers, and run wire brushes. The impact mechanism facilitates drilling into brick or masonry.

This picture costs $22,500 . . . should be $900 more

You may never have to handle pulpwood, but this is a splendid example of where false economy might prove costly.

Actually it's the pulpwood handling crane that costs $22,500—not its picture. But this mechanical giant couldn't lift a matchstick without the wire rope sinews that control its operation . . . Ordinary wire rope would cost about $750. For about $900 you could rig with the *best*—Preformed wire rope made of Improved Plow Steel.

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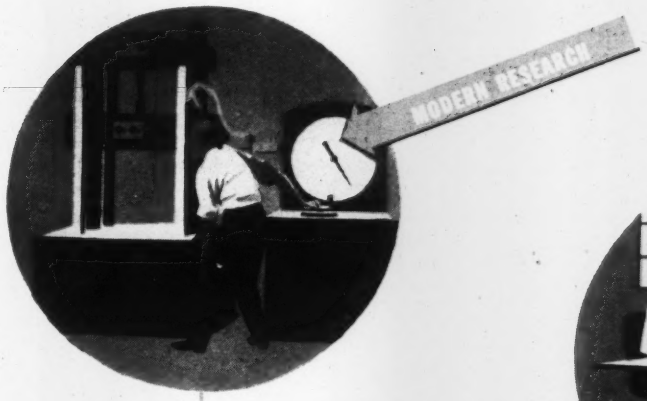

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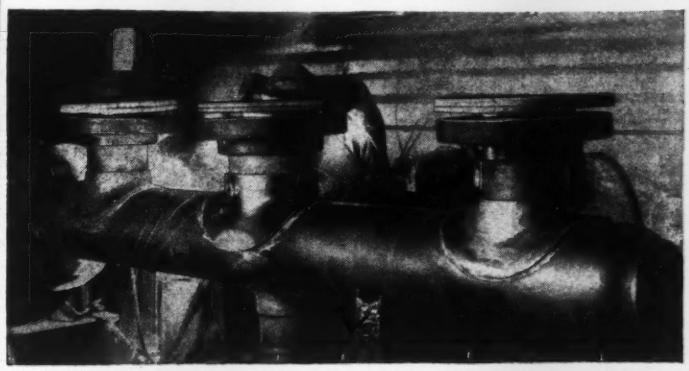

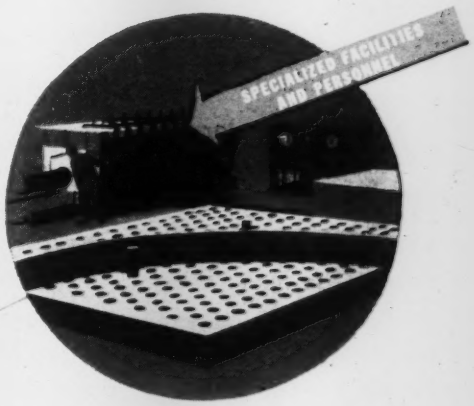

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Every day more and more concrete users — contractors, road builders, and engineers are discovering the many advantages to be gained when DAREX AEA is used in their concrete.

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- Facilitate placing of concrete
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- Reduce green shrinkage
- Reduce bleeding
- Speed up finishing
- Eliminate sand streaking
- Reduce or even eliminate honeycombing

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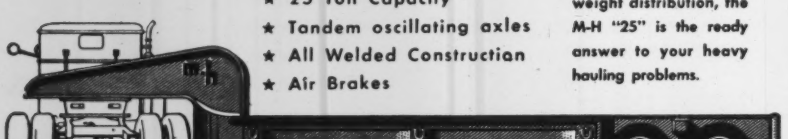
*T. M. Reg. U.S. Pat. Off

RUGGED STRENGTH FOR HEAVY HAULING

The m-h "25" Semi

With electric welding throughout . . . sturdy steel construction . . . and careful attention to weight distribution, the M-H "25" is the ready answer to your heavy hauling problems.

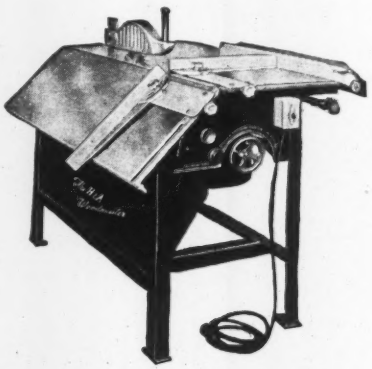
★ 25 Ton Capacity
★ Tandem oscillating axles
★ All Welded Construction
★ Air Brakes



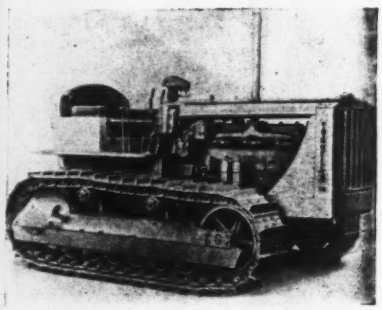
Write for free descriptive folder!

MILLER-HASSELBALCH & CO., INC. 215 NORTH 12TH STREET OMAHA 2, NEBRASKA

MOISTURE-RESISTING PAPER — A moisture and vapor resisting paper known as Presstite barrier paper for the building industry forms a moisture and vapor barrier for side walls between sheathing and facing materials, under flooring and for roof decks. Paper is an excellent grade of tough kraft paper saturated and coated with the highest grade of gilsonite, asphalt and wax compound; it is black, has good flexibility, no odor and will not shrink after wetting.—*Presstite Engineering Co., 3900 Chouteau Ave., St. Louis, Mo.*

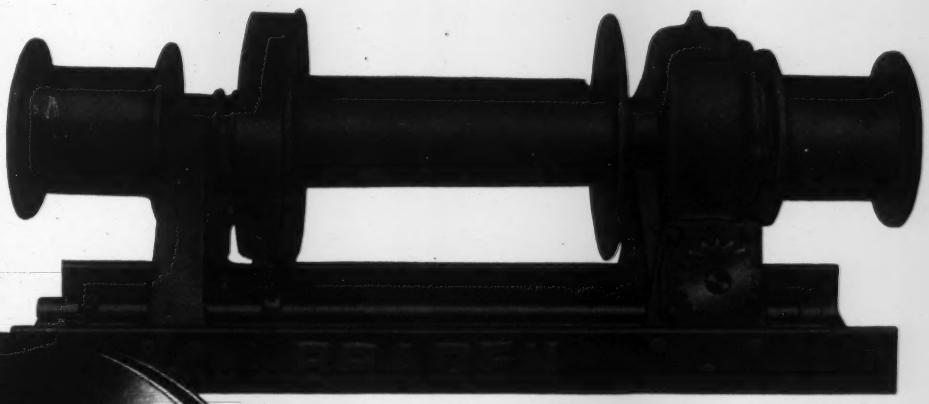


SAW TABLE—Practically a complete woodworking shop, the H & A Saw Table, with light weight, polished aluminum alloy top, can be carried anywhere on the job and operated from any 110-220 volt, 60 cycle outlet. Table top is 39 in. wide by 51½ in. long. Many processes can be handled with speed and accuracy. Saw carriage rolls on life-sealed ball bearing rollers providing feather-touch and easy operation.—*Heston & Anderson, 615 W. Kirkwood St., Fairfield, Iowa.*



GRADERS AND TRACTORS — Two Caterpillar diesel motor graders and two track-type tractors now in production are built around two new diesel engines, the 6-cylinder D318 and the 4-cylinder D315. The No. 12 motor grader now of 100-hp. is said to operate at rates not hitherto approached by this unit and the No. 112 at 70 hp. is

MODEL M9-18B
Safe Working Load of
18,000 lbs.



Why BRADEN WINCHES are Safer

The new Braden Oil Cooled Fully Adjustable, Automatic Safety Brake is the only oil cooled brake in the winch industry. Oil Cooling provides maximum cooling benefits, cuts down on brake lining wear, and assures safe braking action under all conditions. The automatic action eliminates frequent adjustments, and when adjustments are necessary (usually from one to three years) a simple turn of a wrench does the job. All Braden Models rated 12,000 lbs. or over are equipped with Oil Cooled, Fully Adjustable, Automatic Safety Brakes.

The New Braden Oil Cooled, Fully Adjustable, Automatic Safety Brake was developed by Braden engineers after years of experimenting with all types of winch brakes. In all tests with other type brakes the Braden-developed Oil Cooled Brake won out hands down for safe braking action, ease of operation, and trouble-free performance.

"BUY BRADEN—THEY ARE SAFER"

BRADEN WINCH COMPANY
1001 East Admiral Boulevard

BRADEN Winches

TULSA 3,
Oklahoma

Enjoy "next door" convenience with all your suppliers

It doesn't matter where the supplies and replacement parts you need are located. They can be delivered to you in hours when you specify Air Express. Air Express gives you same-day delivery between many towns and cities. Even overnight coast-to-coast shipments are now routine.

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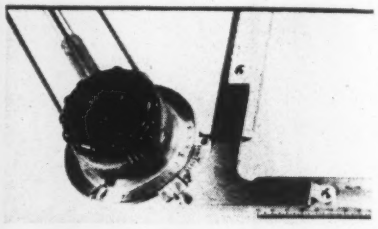
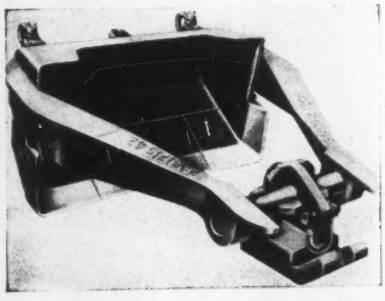
Rates are low

For example: to Air Express a 22-lb. shipment **1100** miles costs only **$7.43.** 10-lbs. for **$3.58.** Other weights—any distance — similarly inexpensive.

qualified to perform jobs hitherto reserved for only the largest size grader. Features of these graders are: (1) constant-mesh transmission, with helical gears; eliminating necessity of stopping to change speeds; (2) six forward speeds, one for every type of job; (3) power-operated mechanical controls; (4) arched front axles for maximum clearance. The two new tractors also are built for higher average working speeds, accomplishment of more work and greater earning capacity. The D4 and D6 will develop 43 and 65 drawbar horsepower respectively, increasing pull which means bulldozer loads moved at higher speeds and faster scraper hauling to move more dirt.—*Caterpillar Tractor Co., Peoria, Ill.*



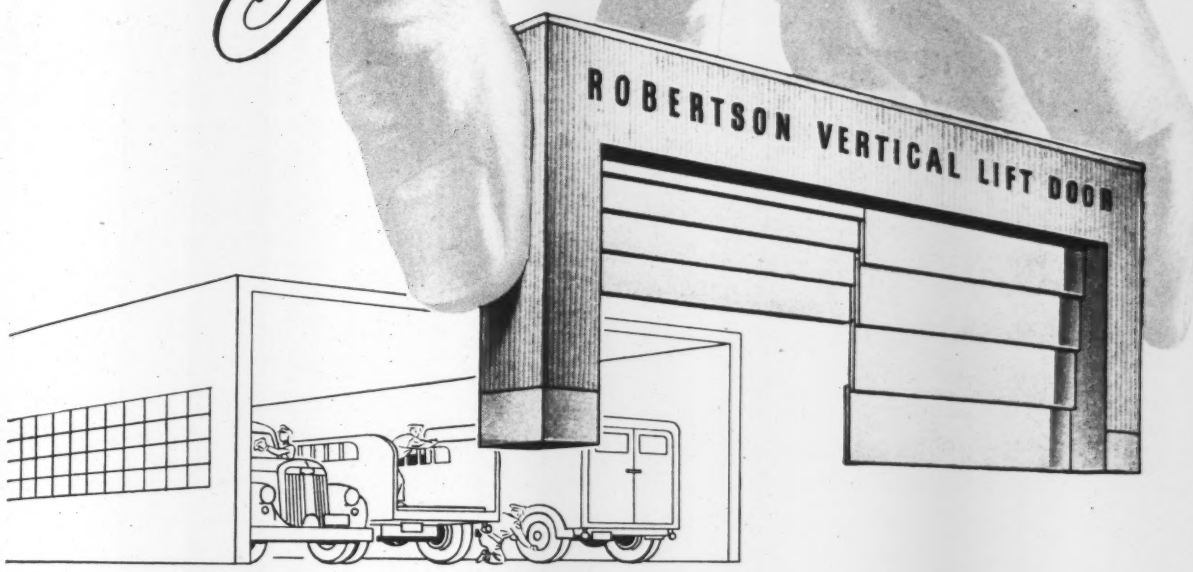
DRAFTING MACHINE—A new model of Vemco drafting machine has covers that protect the bands, exclude dust and dirt, and improve the appearance of the machine. They are steel, so designed that they do not interfere with the flexibility of the drafting head of the machine. Braking action has been much improved.—*V & E Manufacturing Co.*, 758 *Fair Oaks Ave., Pasadena, Calif.*



DRAG SCRAPER—Designed for haulage and transfer operations in mines, rock plants and quarries, a new drag scraper is "balanced" so that its entire weight goes into the digging action. Yet, when loaded, digging action ceases, relieving the scraper hoist of excessive power requirements. On the back haul the scraper tips back on runners, lifting the cutting blades above digging level. Scraper is equipped with newly designed, self-sharpening corner cutters. Available in three models and six sizes: Model A, 26 and 30 in.; Model B, 36

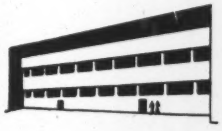
You can engineer the whole front

....Just like this!

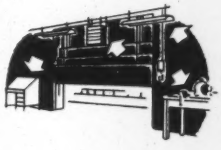


WHATEVER THE SIZE OR PURPOSE of your building, if you need a door or doors, of any size, you can have the entire front end, complete with mechanism, delivered to the site and erected. The Robertson Door nests above, and in front of, the main truss. No working space is stolen from ceiling, floor or walls. You give us the height and width and then—

Specify the details you want



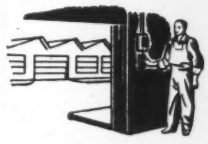
1 Any height, any width, any skin material, with or without windows, heat or sound insulation or sliding pilot doors.

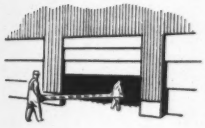


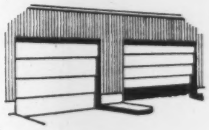
2 Overhead equipment can come right up to the door, retaining maximum ceiling and floor space. Ideal for craneway openings, or as factory partitions.

3 The door is fully counterbalanced, operating electrically or manually. Even largest doors can open completely in 60 seconds.

4 All the leaves reach the top at the same time, or may be stopped at any point to save heat. A safety device is available to halt descent if door touches an object.







5 No trouble with sag or buckle, snow or sand drifts. And the lowest leaf of the door can conform to ground slope.

* * *

Door may be divided into independent sections, still leaving an unobstructed opening.

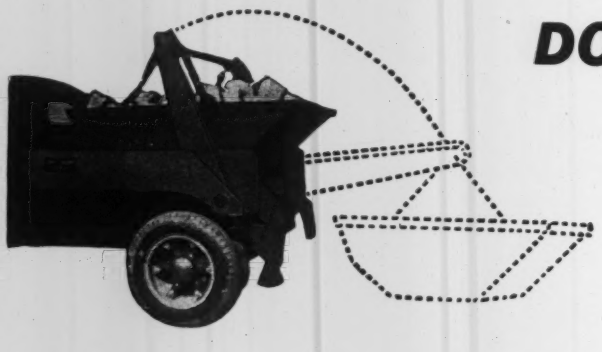
The complete mechanism, the overhead nest and the facade sections can be ordered from Robertson, adapted to your specifications. These doors are now in use all over the country on many types of buildings, small and large. New catalog available. For additional details, call a Robertson representative or write:

H. H. ROBERTSON CO.

2416 Farmers Bank Building
Pittsburgh 22, Pennsylvania

Offices in 50 Principal Cities World-Wide Building Service

THIS WAY you keep MATERIALS MOVING COSTS DOWN!



the Brooks LOAD LUGGER

● Engineers and construction men throughout the world report amazing savings—as high as 300 to 400% in truck maintenance and labor costs alone—with the use of this highly versatile system of materials handling. A Brooks LOAD LUGGER installed on one of your trucks serves any number of detachable bucket bodies. Hydraulic hoist is one-man controlled from driver's cab. Loading crews keep busy constantly loading (at ground level) while trucks and drivers are constantly hauling, dumping, returning empty buckets and picking up loaded ones. Bucket available in a variety of types, sizes and shapes, from 1½ to 8 cu. yds. Write for catalog and list of users today.

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GUNITE work in all its Branches
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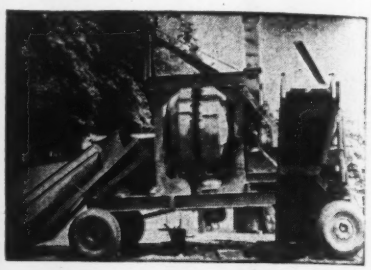
DRILLING
ANYWHERE

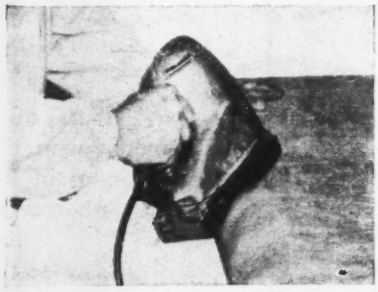
We look into the earth

PENNSYLVANIA DRILLING COMPANY
PITTSBURGH, PA.

and 42 in.; and Model C, 48 and 60 in.—*Alloy Steel & Metals Co., 1862 E. 55th St., Los Angeles, Calif.*



PORTABLE ASPHALT PLANT — Light, inexpensive asphalt mixing plant will be manufactured for newly organized Ford Industries, Inc., by Foote Co., Nunda, N. Y., and first deliveries should be made by latter part of June. It utilizes same type of twin pug-mill used in most costly plants, assuring absolute control and meeting requirements for most exacting product. It produces 40 to 50 tons per hr. of any required density and can be operated by one man. Production is maintained by use of an auxiliary drier as weather conditions may demand. "Skip" feeder and "belt" conveyor are optional.—*Ford Industries, Inc., 197 W. Dunedian Rd., Columbus 2, Ohio.*



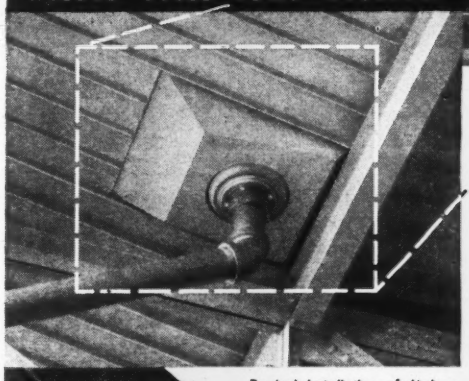
SANDING CURVED SURFACES—For machine sanding of curved surfaces (wood, metal, plastics, etc.) a sponge rubber pad is now available for use with the Sterling portable electric sander. Abrasive sheet is placed over flexible surface of pad in same manner as is done with standard sanding pad. Uses a 3⅔-in.x10¼-in. abrasive paper.—*Sterling Tool Products Co., 363 E. Ohio St., Chicago 11, Ill.*

CORRECTION — In the "Automatic Blueprinter" item in the "*New Aids to the Constructor*" columns in the May 29 issue of *ENR* (p. 77), the wrong illustration was used. The illustration showed the new Revolute A Finisher for developing ammonia-type white prints, rather than the Revolute M4 Automatic mentioned in the writeup.

STEEL DECK . . .

Note the angle of the third and fourth purlins in the illustration above. These have been set to create a drainage valley at the sump location.

WELDED STEEL SUMP RECESSES



Typical Installation of Mahon Welded Steel Sump Recess. These can be furnished to fit any Roof Pitch specified.

Standard Mahon Double Rib Steel Deck Plate. Single Rib Plates are also Available for Sidewalls and Partitions which may be insulated to Any Degree Against Heat, Cold or Noise.

for ROOFS, SIDEWALLS and CEILINGS . . . PARTITIONS and CONCRETE FLOOR FORMS

Every day alert designers and builders are finding Steel Deck ideally suitable for more and more uses in building construction . . . roofs, sidewalls, partitions, floors, and many other applications in the industrial, commercial and residential field. Mahon Steel Deck, due to its basic design with narrow, vertical-leg stiffening ribs, lends itself to a broader range of uses in modern construction. See Mahon Insert in Sweet's File for complete information, specifications, and latest construction details, or consult a Mahon representative.

THE R. C. MAHON COMPANY

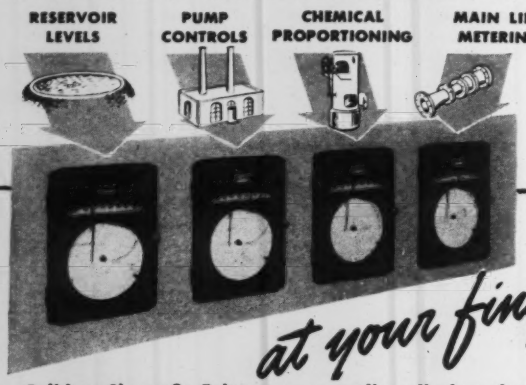
Home Office and Plant, Detroit 11, Mich. • Western Sales Division, Chicago 4, Illinois

Representatives in all Principal Cities

Manufacturers of Steel Deck for Roofs, Sidewalls, Ceilings, Floors, Partitions and Doors. Also Roof Sumps and Recesses, Rolling Steel Doors, Grilles, and Underwriters' Labeled Rolling Steel Doors and Fire Shutters.

MAHON

PLANT-WIDE INFORMATION AND CONTROL



at your fingertips

Builders Chronoflo Telemeters centralize all plant data on one control panel. No longer is it necessary to operate a water works plant by guesswork or to travel long distances reading meters and gauges at remote installations or reservoirs. Builders Chronoflo Telemeters instantly bring complete and accurate readings of level, flow, pressure, temperature, gate position, weight, etc., to the central operating building. They operate over a simple two-wire circuit for any distance, and are widely used for automatic proportioning control of chemical feeding. All Builders Chronoflo Instruments are simple and dependable; their attractive, uniform design enhances the appearance of any water works. For Bulletin 3208, address Builders-Providence, Inc., (Division of Builders Iron Foundry), 51 Codding Street, Providence 1, R. I.

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Venturi, Propelofio and Orifice Meters • Kennison Nozzles
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Instruments

The **JACKSON** **HYDRAULIC VIBRATOR**

Exceptionally **ADVANTAGEOUS for**

GENERAL CONCRETE CONSTRUCTION

Through many years of actual service the JACKSON HS-A1 has thoroughly demonstrated that it is the most dependable and efficient, all-around concrete vibrator for the general concrete contractor. It's virtually trouble-free and does a perfect job of handling the stiffer, more economical mixes. Oil-powered, gas engine-hydraulic pump drive. 4000 to 7000 V.P.M. Vibrator head 2¾" x 21". May be quickly fitted with head for wet or dry rubbing.

The JACKSON line contains the ideal vibrator (internal or external) for every type of concrete construction. Write for information on the type you are interested in.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

Men and Jobs

D. Henry Overman, Columbus, with the Ohio Highway Department since 1918, has been named assistant chief engineer in charge of the bureau of bridges, succeeding **Walter W. Fleming,** who recently resigned. Overman served during the war as a lieutenant commander in command of the 30th Seabee Battalion in Trinidad, Hawaii, and the Phillippine Islands. Fleming resigned to enter the private contracting business with James T. Shidecker of Sunbury, Ohio.

Hal G. Sours, former Ohio state highway director, has been employed by Akron as consulting engineer on that city's super-highway plan.

H. Fred Martin is on the engineering staff of the Garrett Engineering Co., Houston, Tex., and has been made vice-president of the company. He is a civil engineering graduate of Texas A & M College, 1934, and during the war was plant engineer for the Lone Star Ordnance Plant at Texarkana, Tex.

Edwin H. Chapin and **William C. Meyer** have recently started with the Illinois Division of Sanitary Engineering, Springfield, as engineering aides.

Niel B. Nelson, for more than 20 years deputy Pierce County engineer at Tacoma, Wash., has entered the private practice of civil engineering, specializing in court maps land surveying, platting and supervising construction.

Ellsworth W. Bassett, formerly assistant chief of the flood control division of the Office of the Chief of Engineers has joined the Public Works Committee of the U. S. Senate. A civil engineer graduate of George Washington University, he served with the Corps of Engineers at Jacksonville, Fla., for 7½ years on surveys and construction of river and harbor improvements later transferring to the Office of the Chief of Engineers Washington, D. C., where for over 9 years he supervised schedules of flood control construction, worked on budget estimates, and prepared data for presentation to Congressional committees. He will furnish engineering analyses and advice to the Public Works Committee regarding all proposed legislation or other matters referred to that group.

Wilbur W. Davis, chief engineer of the Boston, Mass., transit department an authority on subway and tunnel design, has retired after 45 years with

MEMO to All Construction Supts:

Before we buy Buckets let's check Haiss Hi-Power Ratio 7:1

Among Buckets, Haiss Hi-Power excels through a time-tested combination of many superior features.

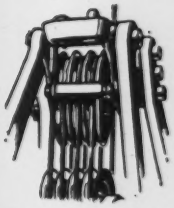
Weight distribution, for instance, is so concentrated that the bucket jaws carry downward to bury the entire bowl to insure the biggest possible payload.

Similarly, when the Haiss Hi-Power tackles a stuck-fast boulder it "grabs tight" to shake and tug until it's loose and "hoist away".

Investigate now the greater efficiency that comes naturally with buckets engineered by Haiss. Catalogs on request.

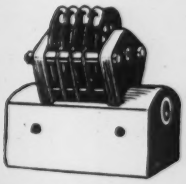
GEORGE HAISS MFG. CO., INC., 140th Street & Rider Avenue, New York 51, N.Y.

Distributors in all large cities



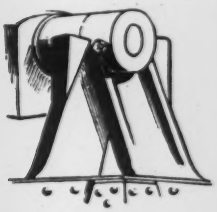
HIGHEST CLOSING RATIO (up to 7:1)

Can be reeved 3, 4, 5, 6 or 7:1 for speed or power as required. Exclusive 4-Position Wedge-Lock dead ending keeps reeving always parallel and 100% centered in sheave grooves.



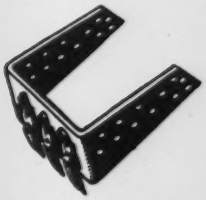
LOWER SHEAVES HIGH ABOVE COUNTERWEIGHT

Up, out of the muck. Non-pocketed. No place for dirt to jam, to cause friction or undue rope wear. Bolt holes in block provide for added counterweight.



CAST STEEL BLADE ARMS FOR STIFFNESS

Rib-reinforced. Rigid strength and extra long bearings (renewably bushed) keep bowl closing true. Full efficiency; bigger payloads.



HEAVIEST JAWS OF ANY BUCKET OF ITS KIND

Abrasion resistant alloy. Will stand heavy battering and still hold shape. Chisel-point or pick-point teeth of similar extra strength.

HAISS

PORTABLE CONVEYORS ★ LOADERS ★ CLAMSHELL BUCKETS

Worthington-Ransome Blue Brute Distributors

See ad on page 115 for list of equipment in each line

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Ida., Boise, Olson Manufacturing Co.
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Ky., Harlan, Croushorn Equip. & Supply Co.
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Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
St. Louis, W. H. Reaves
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Flint, Gransden-Hall & Co.
N. Y., Buffalo, Dow & Co., Inc.
New York, Air Compressor Rental and Sales
O., Cleveland, Gibson-Stewart Co.
Toledo, The Kilcorse Mach. Co.
Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.
Texas, El Paso, Equip. Supply Co.
Washington, Seattle, Star Machinery Co.
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Blue Brute Diesels

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
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the city. A graduate of Massachusetts Institute of Technology, 1900, he participated in the first Boston subway project, the original Tremont St. Subway, opened in 1897. He recently completed the plans and specifications for a proposed second traffic tunnel under Boston Harbor for extending the rapid transit system beyond East Boston.

J. L. Linton has been appointed successor to **H D. Dawson,** who recently resigned as city engineer at Nelson, B. C. Mr. Linton, who began his career as bridge engineer for the Manitoba government in 1924, has been with the Mannex Construction Co. From 1927 to 1928 he was resident engineer in the Manitoba highway department and for four years afterwards was with the Saskatchewan public works department.

Arnold W. Milliken, vice-president of the New York State Gas & Electric Corp., is in charge of technical operations in Binghamton, N. Y., and will supervise construction engineering of the utility in that area.

Leslie G. Sumner, director of engineering and construction for the Connecticut State Highway Department since 1945, and connected with the department for 31 years, plans to retire June 30. Prior to 1945 Mr. Sumner was in charge of the construction of all bridges. He began with the department as a draftsman in 1916.

E. A. Holbrook, dean of engineering at the University of Pittsburgh and **Henry Lowe Brownback,** Norristown, have been named to the Pennsylvania State Sanitary Water Board by Governor James H. Duff. The board is in charge of the present state anti-pollution drive which has resulted in more than 800 municipalities and industrial firms being ordered to construct either sewage disposal or sewage treatment plants.

Joseph E. Herzog, Steele County highway engineer at Owatonna, Minn., has resigned to become personnel manager for the Josten Manufacturing Co., Owatonna.

Sam Ward, new city engineer at Dillon, Mont., succeeds **E. E. Patrick,** who resigned to enter private contracting business. For the last ten months, Mr. Ward has been a party chief for the U. S. Bureau of Reclamation and has been making dam site surveys in Beaverhead County.

Hervey O. Reed has been appointed construction engineer for the Kansas State Highway Commission, succeeding **George Tiffany.** Reed has been assistant construction engineer since 1934. Tiffany, who resigned to accept a position with a construction company in Kansas City, has served as highway engineer since 1941.

J. K. Waitt, who received his civil engineering degree at North Carolina State College, has been appointed valuation engineer for the Seaboard Air Line Railroad, at Norfolk, Va. He succeeds **T. W. Roby,** recently named chief of research and planning.

William Storrie, Toronto, Ont., consulting engineer, is winner of the 1947 Kenneth Allen Award for outstanding service in the field of sewerage and sewage treatment works. The announcement was made by the Canadian Institute of Sewage and Sanitation for the donors, the Federation of Sewage Works Associations.

Findley B. Chappelear, Zanesville, Ohio, has been appointed Division Five engineer of the Ohio Highway Department, with headquarters in Newark, succeeding **Howard P. Christy,** Mt. Vernon. The division embraces Knox, Licking, Fairfield, Perry, Juskingum, Guernsey and Coshocton counties.

W. U. Smick has been appointed vice-president of the engineering construction of Foundation Company of Canada Ltd., Montreal, Que.

N. Eugene Campbell, civil engineer of New Castle, Ind., is going to El Centro, Calif., as an engineer with the Imperial Irrigation district.

George D. Waddill, 70, an expert on revetment, is retiring from the Mississippi River Commission at Vicksburg, Miss., after 50 years with the U. S. Engineers. In times of flood Mr. Waddill always was assigned to the most critical sectors to supervise emergency work.

Planners for the Essex east-west freeway in New Jersey will be the firm of **Edwards and Kelcey,** consulting engineers, of Newark and New York. State Highway Commissioner Miller has announced. The firm has been instructed to survey the complete east-west traffic problem in the Essex metropolitan district and submit a recommendation, including detailed route and profile plans, for throughways needed to meet present and anticipated needs.

J. V. Thompson, formerly with the city engineering department at Wilmington, N. C., is superintendent of a newly-created municipal highway department. **J. A. Loughlin** remains as city engineer.

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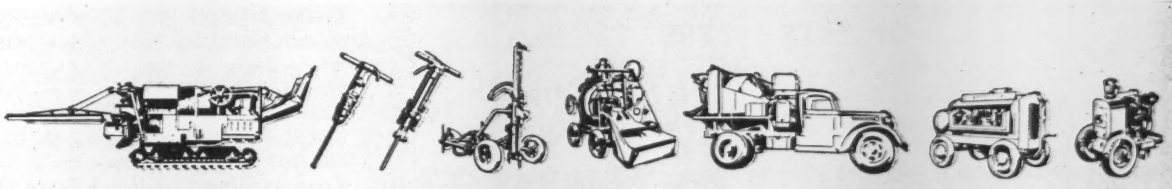

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Elections and Activities

Prof. James Holt has been elected president of the Engineering Societies of New England, Inc., succeeding Prof. Albert Haertlein of Harvard, who filled this office for the last two years. Professor Holt holds B. S. degrees from the Massachusetts Institute of Technology and Harvard University, and has been professor of mechanical engineering at M. I. T. since 1935, preceded by an extended teaching career which began in 1919 at the institute. He was appointed executive officer of the M. I. T. course last year. His extensive consulting work includes three and a half years part time for Fay, Spofford & Thorndike, Boston, designing mechanical equipment for the Army base in Newfoundland.

Other officers elected are William C. White, dean Northeastern University school of engineering; first vice-president; Carroll A. Farwell, consulting engineer, Boston, second vice-president; Kerr Atkinson, consulting engineer, treasurer; and Raymond L. Smart Boston Edison Co., secretary.

At the recent 25th anniversary dinner of the organization, the annual award for eminent achievement in engineering was presented to Prof. Charles Stark Draper, director of the instrumentation laboratory, Massachusetts Institute of Technology.

The North Dakota Society of Professional Engineers has elected these officers: Leslie A. French, Bismarck, president; Harry S. Dixon, Fargo, vice-president; and George Teskey, Bismarck, secretary-treasurer. The retiring president, John B. Jardine, of Fargo, was named national director.

H. Remington Kohler has been elected president of the Monroe, N. Y., chapter of Professional Engineers. Other new officers are: Lewis J. Sforzini, vice-president; Harry O. Bagley, secretary; Hiram W. Barnes, treasurer, and Calvin A. Brown, Fray D. Dickason and Louis J. Sommerhays, directors. Retiring President Edward Haas announced that the chapter had been awarded the "president's gavel" for the highest membership gain of any

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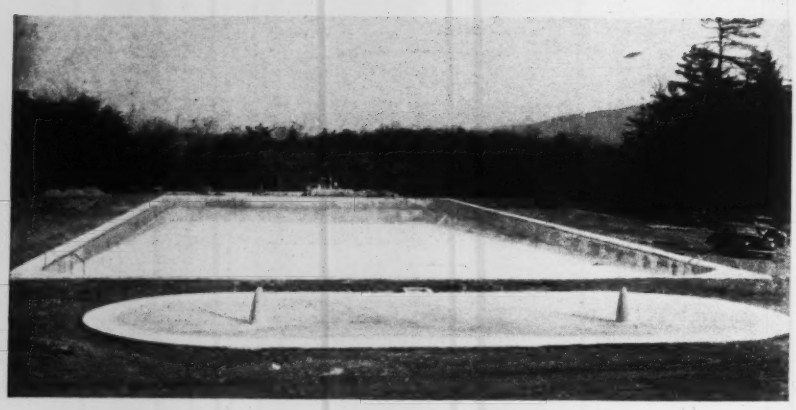

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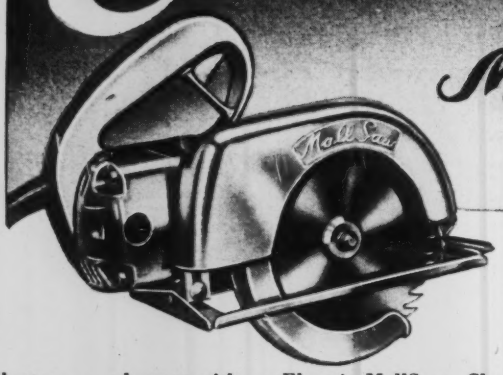

Every cutting job—cross-cutting, ripping, dadoing, angle cutting, bevel cutting, multiple cutting, mortising, scoring, or cutting light gauge metals—can be done faster . . . better . . . cheaper with an Electric MallSaw. Clean, quick, accurate cuts save time—provide square board ends . . . assure better fitting . . . eliminate waste. The Model 70 MallSaw has a 2¼" capacity on straight cuts; the Model 86—2⅞". (Capacities vary slightly on bevel cuts.) Larger and smaller models are also available. All are equipped with powerful Universal motors.

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chapter in the state during the last year.

Officers elected for the Southern Section of the Illinois Water Plant Operators, are: chairman, John Gustat, water superintendent, Johnston City; Secretary, Carl Frayley, chief operator, Murphysboro Water Co.

New officers of the Southwest Idaho Section of the Idaho Society of Engineers are: Linn F. Erickson of the state bureau of highways, chairman; Clyde Humphreys, Boise engineer, vice-chairman, and Earl Haroldsen, Idaho Power Co. secretary. The group went on record in favor of recommending affiliation with the National Society of Professional Engineers. The proposal will be acted upon at the next annual meeting.

Donald E. Sterns has been nominated as president of the Syracuse, N. Y., section of the American Society of Civil Engineers. Others nominated are: Emil M. Graf, Syracuse, vice-president; Earl F. O'Brien, Syracuse, vice-president; Augustus W. Rogers, Watertown, director; Richard G. Coulter Phoenix, secretary-treasurer.

M. J. Aykroyd, civil engineer of Toronto, Ont., has been elected president of the Dominion Council of the Professional Engineer's Association of Canada. He succeeds P. Burke Gaffney of Winnipeg, Man. F. Forward of Vancouver, B. C., was elected vice-president and M. B. Atson of Toronto, secretary.

Raymond A. Kirby, director of the Toledo, Ohio, Metropolitan Housing Authority, has been elected president of the four-state East Central Regional Council of the National Association of Housing Officials for Ohio, Michigan, Indiana and Kentucky. He will assume office Dec. 1, replacing Jack B. Bryan, managing director of the Lexington, Ky., Municipal Housing Commission. Mr. Bryan was named to the executive committee. Other officers elected were Robert Temple, chief of the management division of the Detroit Housing Commission, vice-president; Hugo C. Schwartz, Cleveland, assistant regional director of the Federal Public Housing Authority, secretary; and Stanley Wojcik, director of the Hamtramck, Mich., Housing Commission, treasurer. Named also to the executive committee were Ramsey Findlater, director of the Cincinnati Housing Authority, and J. E. Harris, member of the Louisville, Ky., Housing Authority.

Charles B. Lawrence, Jr., Cleveland, regional director of the FPHA, at a recent meeting urged that communities make immediate plans for removal of

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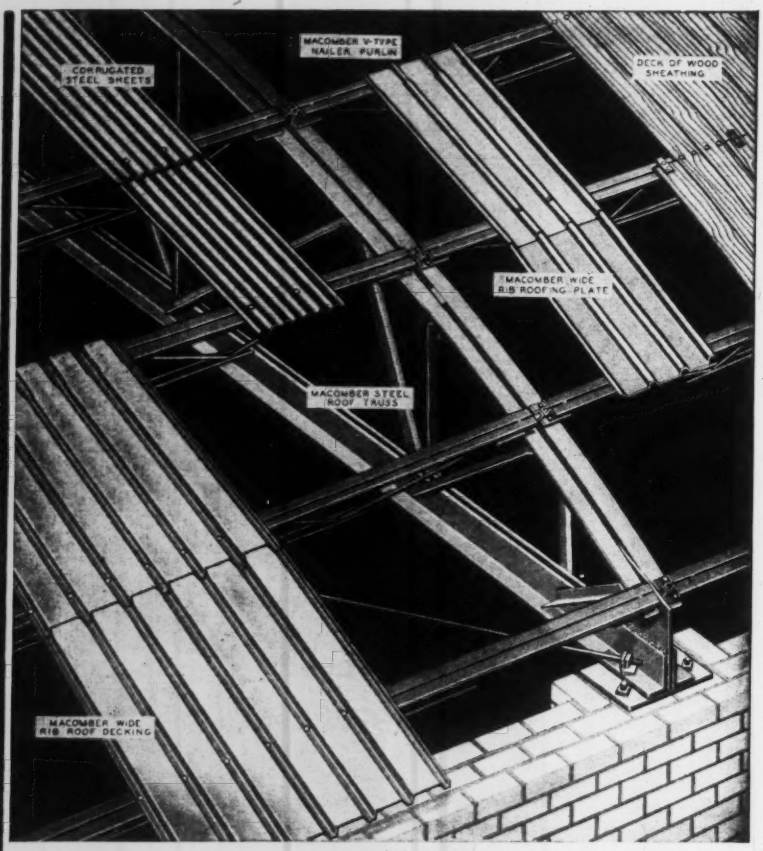

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temporary housing units, which do not maintain housing standards. He said that there are 100 applicants for every vacancy that appears in the region's 200 communities which have government housing projects.

Charles Abrams, New York City housing authority, told the group that the current housing emergency cannot be ended until it is treated as "a long range problem requiring long range remedies." He said minimum housing needs will require the building of houses equal to more than half the present 40 million units within the next 15 years.

M. B. Garris, Miami, has been elected president of the Florida Engineering Society. Other officers are W. Gellespie, Jacksonville, first vice-president; A. P. Michaels, Orlando, second vice-president; Davis S. Lee, Jacksonville, secretary; R. A. Chase, Jacksonville, treasurer. Directors, J. B. Heirs, Miami, J. F. Reynolds, Jacksonville, and W. H. Beisler, Gainesville.

At the recent annual meeting of the North Carolina Section of the American Society of Civil Engineers proposed legislation to be recommended by the State Board of Health at the next session of the state legislature for the abatement of stream pollution was discussed. Nathaniel P. Hayes of Greensboro presided and John D. Watson of Greensboro was in charge of the program.

At the recent annual meeting of the St. John, N. B., Branch of the Canadian Construction Association, officers were named as follows: President, H. C. Lawton; vice-president, H. Peer; secretary, J. N. Flood; treasurer, C. S. Christie, Jr.; Sergeant-at-arms, G. M. Glood. On the executive, W. G. Usher, H. S. Stephenson, J. P. Campbell, E. A. Ritchie, for R. L. Grannan, and R. H. Patterson and J. H. Kennedy.

William T. Kahler has been installed president of the Western Society of Engineers, Chicago, Ill. He is president of the Illinois Bell Telephone Co.

Sidney E. Fenstermaker has been elected president of the Construction League of Indianapolis, Ind. Others elected were: Carl Weiland and J. Ralph Fenstermaker, vice-presidents; Homer Eichecker, secretary; and Reilly Adams, treasurer. New directors are W. W. Logan, William C. Grauel, Mark Owen, George Caleb Wright, Arthur Vebling, Louis W. Brandt, Harold Schiele, James H. Carnine, W. L. Moore, Lewis S. Finch, Fred L. Palmer, and William L. Bridges.

LaPlant-Choate scrapers are the only job-proved, completely modern, postwar models with all these profit-making features: 25% easier loading — lower horsepower requirements — faster, cleaner, smoother spreading — positive forced ejection — open bowl — no useless dead weight — low center of gravity — modern, high strength alloy steel — modern, high natural rubber content tires — sturdy construction — low maintenance cost and high trade-in value. As the result, operating records on hundreds of tough earthmoving jobs, working in all kinds of materials, prove that LaPlant-Choate scrapers outperform other leading scrapers by wide margins.

Now, look what this performance means in dollars and cents. Even if you were able to obtain other scrapers at half price, within six months you would have been way ahead by buying a new LPC scraper. Within a year, you would be better off even if you got the other as a gift. Then, for thousands of hours, your profits will roll in still faster.

Any way you look at it, no matter what kind of scrapers you are using now, you'll be money ahead by replacing them with modern, job-proved LaPlant-Choate units. Another advantage, too, is the fact that LPC scrapers in most sizes (from 2 to 14 yd. struck measure) are ready for *immediate delivery.* Your nearest LPC distributor can tell you how hundreds of contractors are using "higher income" LaPlant-Choate scrapers to bid lower and still make profits. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; 1022 77th Ave., Oakland, Calif.

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No. of yds. per hr.	74	63*	65*	64**	61***
Estimated earning capacity per hr.	$18.50	$15.75*	$16.25*	$16.00*	$15.25*
Estimated earning capacity for 1000 hrs.	$ 18,500	$ 15,750	$ 16,250	$ 16,000	$ 15,250
3000 hrs.	55,500	47,250	48,750	48,000	45,750
5000 hrs.	92,500	78,750	81,250	80,000	76,250
10000 hrs.	185,000	157,500	162,500	160,000	152,500
15000 hrs.	277,000	236,250	243,750	240,000	228,750

*Manufacturer's own figures. **Estimated. ***Government tests.

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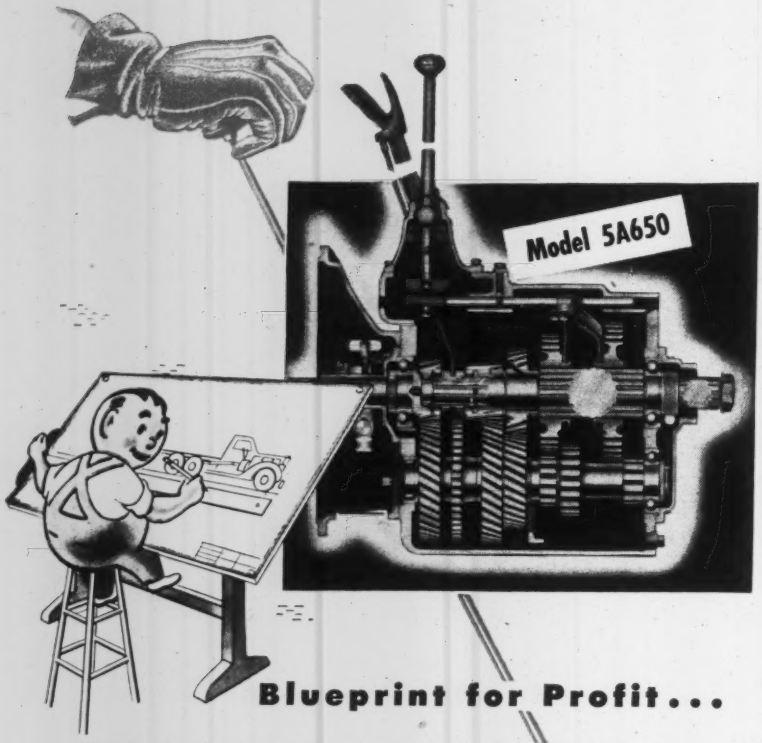

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Manufacturers' Activities

PIONEER ENGINEERING WORKS, INC., Minneapolis, Minn. announces the appointment of two new distributors in Montana: Central Machinery Co., Great Falls, for the northwestern part of the state and Wortham Machinery Co., Billings, the southwestern area.

THE NORTHWEST ENGINEERING CO., builders of shovels, cranes, draglines and pullshovels, announce the removal of their executive and sales offices to the Field Bldg., at 135 South La Salle St., Chicago 3, Ill.

The opening of their new larger factory at Savanna, Ill. was recently announced by C. R. Jahn, President of the C. R. JAHN CO., Chicago, manufacturers of heavy duty, low-bed trailers.

At the annual meeting of NATIONAL CLAY PIPE MANUFACTURERS, INC., G. L. Avery, president of Lehigh Sewer Pipe & Tile Co. of Fort Dodge, Iowa, was elected president of the national association.

In a move to strengthen its export sales department, KAISER COMPANY, INC., iron and steel division, Oakland, Calif., has announced the appointment of W. J. Gleason as export sales manager.

The appointment of two new divisional managers of the parts department of CATERPILLAR TRACTOR CO., Peoria, Ill. and nomination of their assistants has been announced. C. D. Byrns has been named manager of the eastern division and Eldon L. Mason manager, western division. B. J. Grimm has been appointed assistant manager of the eastern division and E. W. Ryder, transferred to the western division.

GEORGE W. KELSEY, a director and general sales manager of Builders Iron Foundry, Providence, R. I., for the past several years, has been named a vice president of that concern. He is also identified with three Builders Iron Foundry subsidiaries.

M. O. STOCKLAND, JR., former sales promotion manager of the Four Wheel Drive Auto Co., has been appointed manager of the newly consolidated sales promotion and advertising department.

Appointment of FLOYD JONES as sales

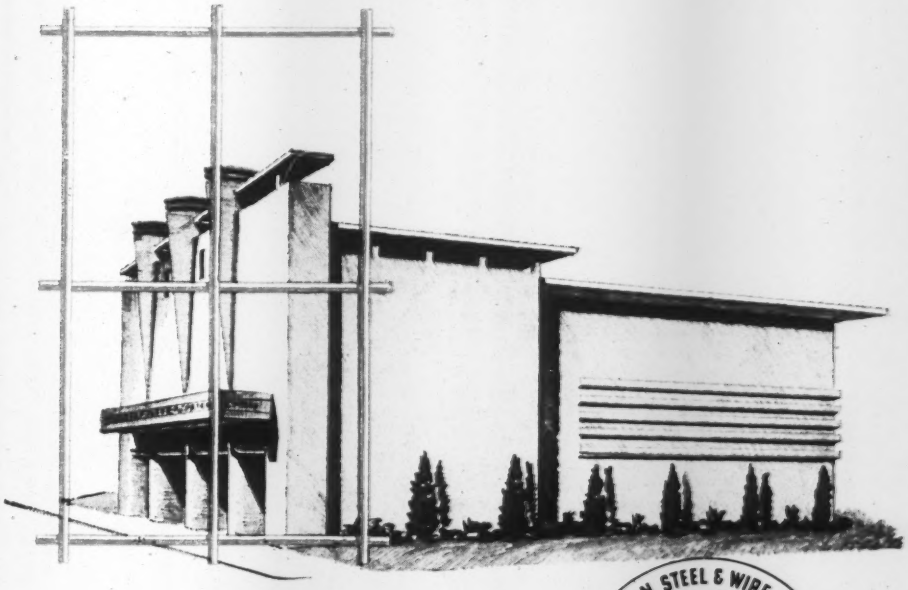
Every concrete slab needs reinforcement!

specify AMERICAN WELDED WIRE FABRIC

● This *proven* fabric gives you a *better* reinforcing job because closely spaced steel wires fortify wall, floor and roof slabs against all-directional strains and shocks.

In every concrete structure there is a place where U·S·S American Welded Wire Fabric is the most economical and the most efficient reinforcement.

When you use American Welded Wire Fabric you are assured of satisfaction, both as to products and as to service, by the world's largest maker of fabricated concrete reinforcement.



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Columbia Steel Company, San Francisco, Pacific Coast Distributors
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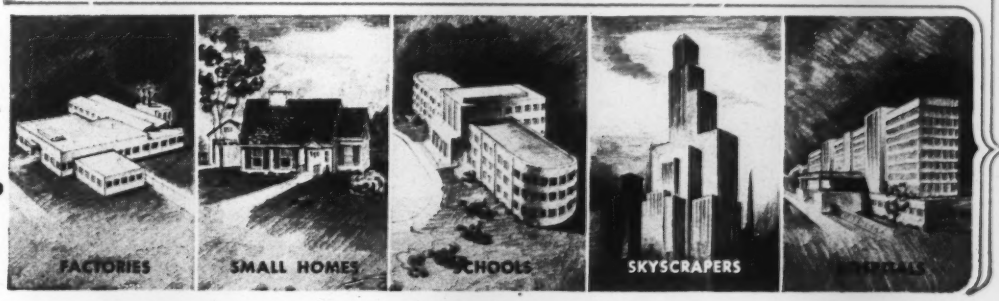
Every type of concrete construction needs American Welded Wire Fabric reinforcement.



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This picture of destruction is not a pleasant one—nor a needed one. For with ever watchful "Automatic" Sprinkler Protection, fire just doesn't have a chance to make headway . . . it's stopped at its origin . . . damage is held to a minimum.

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IT BLANKETS • IT ISOLATES • IT QUENCHES

—a famous member of the "Automatic" Sprinkler Family. Provides adequate protection for quench tank, transformer, oil line and other fires of flammable liquid origin.

Loss of life by fire or cessation of manufacturing and selling operations because of fire is inexcusable. Such losses are needless and incalculable. 24-hour a day fire protection for every business is a must.

Call upon an "Automatic" Sprinkler engineer for assistance on any fire protection problem. He can even show you how savings will pay for installations.

With apologies to Senator Claghorn

FIRE PROTECTION
DEVELOPMENT ENGINEERING
"Automatic" Sprinkler
MANUFACTURE INSTALLATION
"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA

manager of the portable compressor division of the Davey Compressor Co., Kent, Ohio, was announced recently.

As a result of favorable action at stockholders' meetings, the consolidation of Florida Portland Cement Co., Signal Mountain Portland Cement Co. and Trinity Portland Cement Co. to form GENERAL PORTLAND CEMENT CO. with headquarters at Chicago, Illinois, has been announced.

KAISER STEEL CO., Oakland, Calif., reports the promotion of Richard L. Erlin from general sales service manager to the position of manager of rolled steel products sales. He is being succeeded as general sales service manager by O. D. Hole, Jr.

A. W. GUENTHER, export manager for Harnischfeger Corp. at Milwaukee, has been transferred to the firm's Los Angeles branch office where he will have charge of export sales.

HARNISCHFEGER CORP., Milwaukee, builder of P&H products, has announced the appointment of Ralph D. Holcomb as general sales manager. He will direct the sales of all P&H products, excavators, road machinery, hoists, cranes and welding equipment.

After 52 years in the pipe business, EDWIN P. COREY has tendered his resignation as general manager of Tubular Sales of The Youngstown Sheet and Tube Co., Youngstown, Ohio.

LADISH CO., Cudahy, Wis., has established a new district office at 452 Spring Street, N. W., Atlanta, Ga., and discontinued its New Orleans office.

ALBERT E. ZEISEL has become vice-president in charge of sales for the Eutectic Welding Alloys Corp., W. Sigmund is vice-president in charge of production and T. H. Leston has been appointed chief engineer of the corporation's new New York plant.

JAMES H. MORRIS has been appointed president of the John W. Patterson Co., Pittsburgh, Pa.

ROBERT P. NICHOLS has been appointed assistant domestic sales manager for R. G. LeTourneau, Inc., Peoria, Ill.

ROBERT P. TYLER has been elected vice-president in charge of sales for Macwhyte Co., Kenosha, Wis.

THE AMERICAN ROLLING MILL CO., Middletown, Ohio, has assigned Glen Hoover to direct important accounts in Canadian territory, working out of the

Buffalo, N. Y. offices. Don H. Hogan has become manager of the Cleveland District.

THE RICHKRAFT CO., Chicago, Ill., announces the appointment of four new distributors: T. H. Rogers Lumber Co., McAlester, Okla.; General Sash & Door Co., Tulsa, Okla.; Walling Sash & Door Co., Wichita, Kans.; and Stark & Co., Kansas City 8, Mo.

After having been located for 49 years in the Marquette Building at 40 South Dearborn St., MARQUETTE CEMENT MANUFACTURING CO. general offices have moved to 20 North Wacker Drive, Chicago, Ill.

SNAP-ON TOOLS CORP., Kenosha, Wis. has opened its 40th factory outlet at Fargo, N. D.

The country's newest vitrified clay sewer pipe plant will get into production in July, considerably ahead of schedule, TEXAS VITRIFIED PIPE CO., Mineral Wells, has announced. It will concentrate on 4 and 6-in. clay sewer pipe.

HENRY D. OSTERHOLZ has become general sales manager of Anderson Brick & Supply Co., Inc., New York 35, N. Y. The company has been in the building material business for 25 years.

THE YOUNGSTOWN SHEET AND TUBE Co. announces the appointment of G. W. Chistopher as manager of standard pipe sales and J. W. Owings as manager of oil country tubular sales.

THE J. D. ADAMS MANUFACTURING Co., Indianapolis, Ind. announces the appointment of Buel Wallis as eastern division sales manager. All sales east of the Mississippi will come under Mr. Wallis' jurisdiction, as well as federal sales.

FRANK E. GERLITZ, JR. has been appointed sales manager of the Simplex Valve & Meter Co., of Philadelphia, Pa.

W. E. KIMBROUGH has been appointed manager of the truck section of the Ford Motor Co. He will be located at the central office in Dearborn.

Rapid growth of industry throughout the southwest has resulted in a further expansion of the Houston office of the MINNEAPOLIS-HONEYWELL REGULATOR Co., it is announced.

THE FOUR WHEEL DRIVE AUTO CO. announces the establishment of sales headquarters in the Masonic Building, Duncan, Okla. for its southwestern sales region. This territory includes the

You can control the cost of the damage to your hydrants that are damaged in traffic accidents if they are MUELLER-COLUMBIAN because the SAFETY FLANGE takes the shock when it is hit a sufficient blow to cause damage. There is no loss of water, one man can install a new SAFETY-FLANGE section in a few hours time, and the cost for parts is less than $8.00.

Simple way to control costs, isn't it?

DEPENDABLE SINCE 1857 · FULLY WARRANTED FOR OUR 90th YEAR

MUELLER CO.

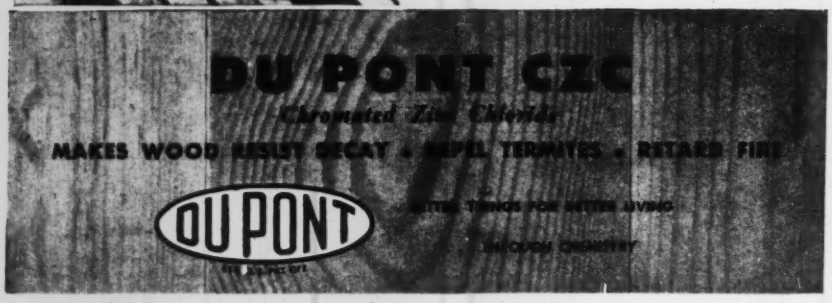
FACTORY: *Chattanooga, Tenn.* MAIN OFFICE AND FACTORY: *Decatur, Ill.*
OTHER FACTORIES: *Los Angeles, Cal.* • • • *Sarnia, Ont. Canada*

Outdoor stadium seats built of "CZC"–treated wood give years of extra service. They are protected from decay, termite attacks and the hazard of fire damage from discarded matches and lighted cigarettes.

Save Maintenance, Replacement Costs

You save on maintenance costs and keep replacements at a minimum when you specify wood that is pressure-impregnated with Du Pont Chromated Zinc Chloride. "CZC"–treated lumber is clean, odorless and can be easily painted.

For full details about Du Pont Chromated Zinc Chloride, write to E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Dept., Wilmington 98, Delaware.


DU PONT CZC
Chromated Zinc Chloride
MAKES WOOD RESIST DECAY • REPEL TERMITES • RETARD FIRE
DU PONT
BETTER THINGS FOR BETTER LIVING
THROUGH CHEMISTRY

Diamond Core Drilling

CORE BORINGS
for Foundations, Dams, Bridges and all Heavy Structures
GROUT HOLES

Tinney Drilling Co.
Grafton, W. Va.

High Grade Hardwood

SURVEYOR STAKES

Stained Yellow Bound with Steel Strapping

	Per 100	In 1000 lots Per 100
1x2—12"	$5.05	$4.60
1x2—15"	5.15	4.65
1x2—18"	5.25	4.75
1x2—24"	6.20	5.65
1x2—36"	8.80	8.00
2x2—12"	$6.50	$5.90
2x2—15"	8.15	7.00
2x2—18"	8.70	7.90
2x2—24"	10.45	9.50
2x2—36"	15.00	9.50

Prices net, F.O.B. Cumberland, Md.

BUCHANAN LUMBER CO.
CUMBERLAND, MD.

states of Oklahoma, Texas, New Mexico, Arkansas, Louisiana and Mississippi.

BAILEY METER CO., Cleveland, Ohio, announces the assignment of three engineers to branch offices: R. L. Stewart reported to Denver and L. E. Bartel to Kansas City recently. G. D. Williams is being assigned to Atlanta after temporary duty in Boston.

THE HUBER MANUFACTURING CO., Marion, Ohio, is announcing the addition of Ray W. Keeler to its engineering staff.

ROSS J. BURNS, sales engineer, formerly connected with the Chicago office of the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Co., has been transferred to the Pacific Coast, with headquarters at the San Francisco branch office. He will handle the company's line of Pittsburgh-Empire water meters.

H. C. WALLACE has been appointed manager of Air Reduction's Louisville district, succeeding R. S. Moore, recently deceased.

To meet the increasing demands of industry for quick, efficient service on roller transmission chains, the Atlas Tool and Designing Co. of Philadelphia, has changed its charter to the ATLAS CHAIN AND MANUFACTURING CO.

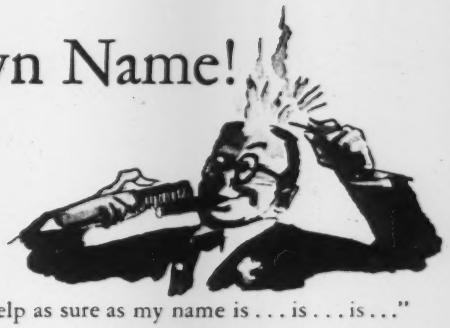
C. E. LOVEWELL, chief engineer for The Carney Co., Inc., Mankato, has been named director of sales for the company's cement division and C. H. Carlson has been promoted to manager of sales for the insulation division.

CATERPILLAR TRACTOR CO., Peoria, Ill., announces the promotion of J. M. Davies as associate director of research in administrative charge of the department and R. C. Williams as assistant director of research in charge of tractor and earthmoving projects. The present assistant directors of research, L. A. Blanc, W. L. H. Doyle, C. R. Maxwell and C. R. Schad have been assigned additional duties in step with the expanding post-war necessity for advanced and efficient machinery.

In keeping with the policy of the EUCLID ROAD MACHINERY CO. to expand its services to distributors and customers, a sales development department, headed by V. L. Snow, has been established. This department will make field engineering studies for the improvement of current Euclid models and the development of new products. It will also prepare material for distributor's use in sales training programs for their personnel.

The Man Who Forgot His Own Name!

by Mr. Friendly



Contractor Potter lit his hair and combed his cigar.

He hung his hat on Mr. Friendly, and asked the hat tree about insurance and accident prevention . . .

"With accidents up, and construction down" he smiled, "I need help as sure as my name is . . . is . . . is . . ."

"John Potter!" said Mr. Friendly.

"That's funny!" said Mr. Potter. "My name's Potter too!"

"No, I'm Mr. Friendly of American Mutual . . . Remember *American*, because it's *America's* oldest liability insurance company . . . It's been helping *American* businessmen for 60 years! . . .

"And *Mutual's* easy, because policyholders *mutually* share profits . . . A saving on premiums that's never been less than 20% . . .

"*American Mutual* . . . Think of A.M. or *am* . . . It *am* cutting down accidents, and speeding up construction through a special, no-extra-charge service called *Five E's** . . ."

"Well, I'll never forget John Potter," said Potter happily, "as sure as my name is *American Mutual!*"

"And I'll sign for a policy right now!" he cried, dipping his secretary in ink.

**5 Big Reasons for Remembering American Mutual!* Learn what they are in free "Five Extras booklet" also "Foremanship and Accident Prevention in Construction." Write: American Mutual Liability Insurance Company, Dept. 0-63, 142 Berkeley St., Boston 16, Mass.

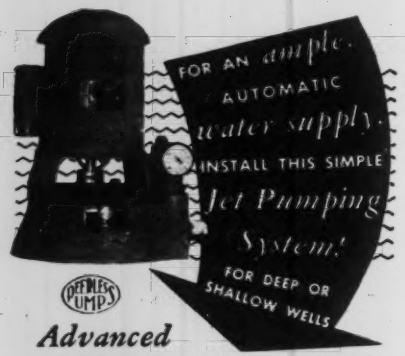
Your helping hand when trouble comes!

A M

AMERICAN MUTUAL

. . . the first American liability insurance company

©1947, AMERICAN MUTUAL LIABILITY INSURANCE COMPANY



Advanced
PEERLESS JET PUMPS

Economically Produce the Water You Require for Light Industrial Needs

CAPACITIES: 120 to 7500 Gals. per Hour. From well depths to 120 Feet.

The Peerless engineering achievement of designing and building more efficient pumps with fewer moving parts has again been most successfully applied in the advanced Peerless Jet Pumping System. The trouble-free Peerless Jet Pump principle ingeniously applies the natural force of gravity, plus a minimum of mechanical power, to lift water upward by pressure from the Jet and force it to a pressure tank by means of an impeller. There is no simpler pump principle now being utilized where water lift requirements are comparable. Peerless Jet Pumps are easy to understand, install, operate and maintain. Once the constant-pressure Jet Pump is in operation, adjustment or repair is rarely needed. Extremely compact in design. Double or single pipe systems available in sizes from ¼ to 3 H.P. Quietly supplies the water you require whether installed over the well or offset at a distance from the water source. Ideally applied to wells 2" inside diameter and larger for water supply requirements of light industry including ice and refrigeration plants, creameries, dairies, milk plants, institutions, hotel, laundries, municipalities, motel, country estates, schools, etc.

See The
PEERLESS
Water King
Unique in design and operation. For shallow well installation only.

Fully protected Under R. Moineau U. S. & Canadian patents.

For trouble-free simplicity of operation, this unique pump utilizes the same "magic" pumping element of the Peerless Hi-Lift Pump. Hard chrome pumping element wholly positioned and protected within pump base is highly resistant to abrasive and corrosive action. Assures a clean constant water supply. Requires a minimum of space and attention. 100% automatic. Easily installed over well or off-set.

Write for Bulletins describing these two most efficient pumps.

PEERLESS PUMP DIVISION
Food Machinery Corporation
Factories: Canton 6, Ohio • Quincy, Ill. • Los Angeles 31, Calif. District Offices: Canton 2, Ohio; Philadelphia: Suburban Square, Ardmore, Pa.; Atlanta: Rutland Bldg., Decatur, Ga.; Dallas 1, Texas.

Manufacturers' Publications

Brickmaking Machine—(8-p. bulletin) Describes new Brickmaster, which can produce 3,000 to 6,000 standard-size units per hour. Illustrations show machine at work, bricks produced, and construction details.—*Brickmaster, Inc., 115 Broadway, New York 6, N. Y.*

Flumes and Venturi Tubes—Calibration, construction, installation and capacity of Simplex Type S parabolic flumes are described in Bulletin No. 210. The parabolic flume accurately measures flow of liquids through partially filled channels. Construction and installation details of Type TG Insert Venturi tubes and nozzles for accurate measurement of flow rate of water, oil, and industrial liquids, are discussed in Bulletin No. 450.—*The Simplex Valve & Meter Co., 6751 Upland St., Philadelphia 42, Pa.*

Liquid Conditioning—A condensed catalog gives concise information on the most modern methods and equipment for treatment of water, purification of process liquids, and recovery of valuable substances from waste liquids. A chart shows the results of treating a given water by six different water-conditioning methods.—*Liquid Conditioning Corp., 114 East Price St., Linden, N. J.*

Escalators—A 20-p. booklet, written for prospective owners of Escalators, prepared in non-technical language. It contains a brief history, several pages devoted to location, maintenance and safety; photographs, drawings and explanations of the driving mechanism and running gear; and a double page of photos showing typical installations in diverse structures.—*Otis Elevator Co., 260 Eleventh Ave., New York 1, N. Y.*

Heater—12-p. illustrated bulletin (No. 516) describes the new Dravo Counterflo heater for industrial and commercial use. This bulletin outlines the successful application of stainless steel to combustion chambers. Other new aspects discussed are: more efficient combustion by the Counterflo method; ready fuel convertibility from oil to gas or vice versa; elimination of refractory lining within the combustion chamber.—*Dravo Corp., Pittsburgh, Pa.*

Couplings—(16-p. bulletin) Gives detailed illustrations and descriptions of new Type F Steelflex couplings, and provides complete, simplified selection tables for both motor and turbine applications.—*Falk Corp., 3001 W. Canal St., Milwaukee 8, Wis.*

Stud Welding—(36-p. brochure) Describes application of stud welding in construction industries. Wide range of studs, used for securing corrugated asbestos and other types of roofing and siding, metal lath, insulation, and other integral construction materials to structural steel frames, is shown, along with various types used in the installation of mechanical, electrical, and sprinkler equipment. — *Nelson Sales Corp., Toledo Ave. and E. 28th St., Lorain, Ohio.*

Dewatering by Contract—(16-p. booklet) Outlines advantages of subcontracting draining of construction areas. Booklet features use of Moretrench wellpoint equipment.—*American Dewatering Corp., 140 Cedar St., New York 6, N. Y.*

Chemical Control Methods—(Illustrated folder) Tells how termites and Lyctus beetles operate and presents evidence to show effectiveness of "Penta" preservative.—*Chapman Chemical Co., 333 North Michigan Ave., Chicago 1, Ill.*

Steel—(8-p. newspaper) Illustrates end uses of steel with a series of unusual action type photographs.—*Joseph T. Ryerson & Son, Inc., Box No. 8000-A, Chicago 80, Ill.*

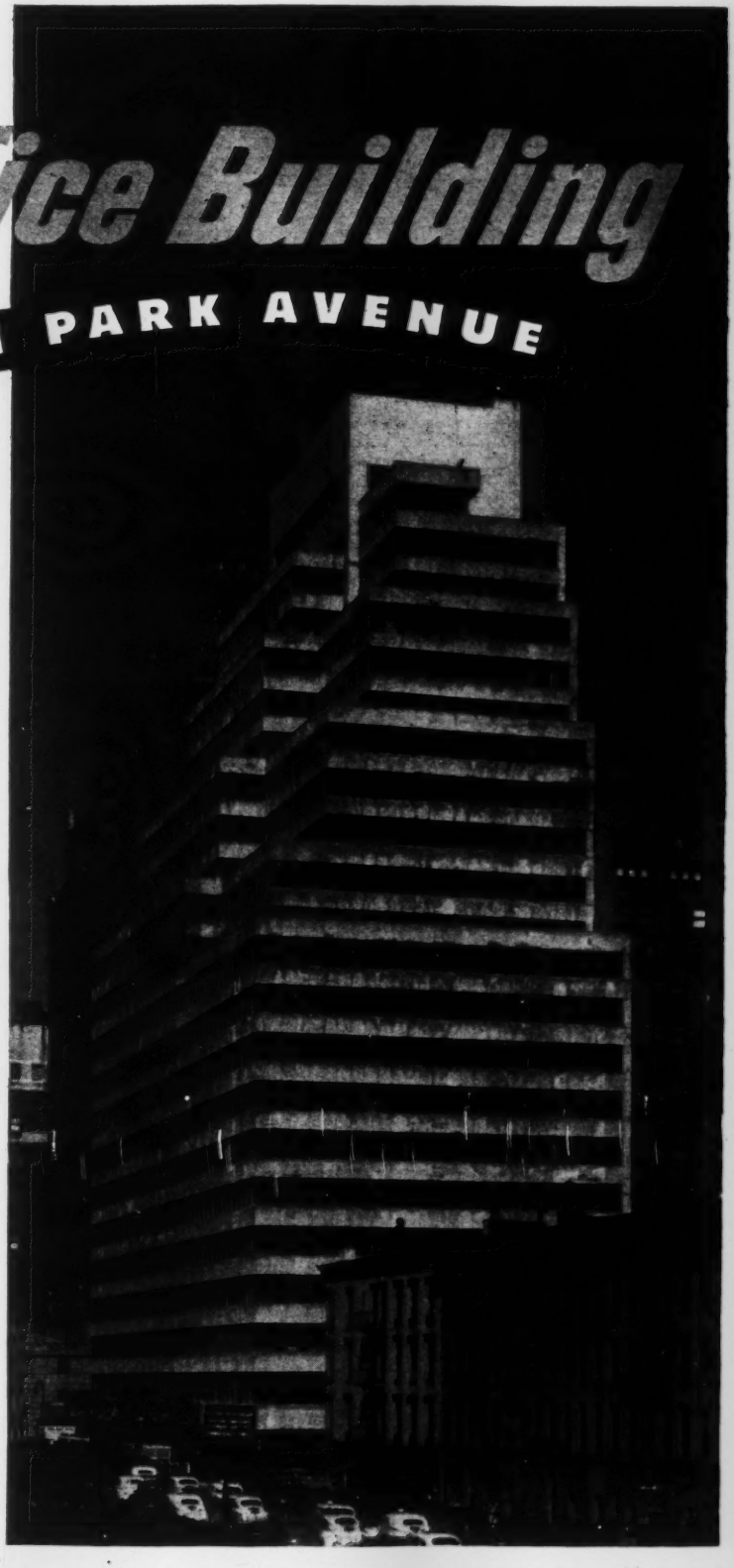
Glued Prefabricated Houses—(8-p. booklet) Lists in concrete form uses of glue in prefab construction and describes latest methods of applying bonding agents and up-to-date techniques for applying pressure and speeding curing of adhesives.—*Technical Service Dept., Casein Co. of America, 350 Madison Ave., New York 17, N. Y.*

Treatment of Exterior Walls—(4-p. folder) Tells story of Hydrocide Colorless, invisible water-repellent treatment for exterior concrete and masonry building walls above grade. Comparative test data are included, as well as results of water-repellency tests made on concrete, masonry and Celotex.—*Building Products Division, L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*

Stereograph Perspective Drawing Instrument—(8-p. folder) Describes

New Office Building

RISES ON PARK AVENUE



Known as 445 Park Avenue, this impressive 22-story structure occupies the entire blockfront between 56th and 57th Streets, New York.

The first wholly air-conditioned office building ever to be erected in the Borough of Manhattan, the structure has a gross area of 340,000 sq ft, and follows a type of construction in which all exterior columns are recessed so as to permit an even distribution of light.

In this, as in scores of other construction projects the country over, the fabrication and erection of steel have been entrusted to Bethlehem. Whenever you have new construction in mind, regardless of type, size or location, remember that Bethlehem has the facilities to handle it to your complete satisfaction.

Bethlehem Steel Company, Bethlehem, Pa.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

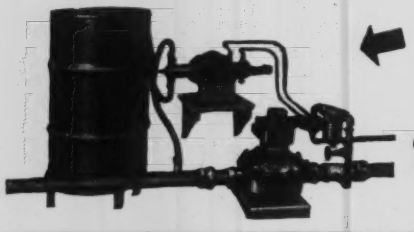
Owner: Tishman Realty & Construction Co. *Architects:* Eli Jacques Kahn and Robert Allan Jacobs. *Consulting Engineer:* Fred N. Severud.

FABRICATED STEEL CONSTRUCTION

WATER WORKS MEN *are smarter than people!*

Most people think any clear water is safe to drink but water works men know better! They realize that water to be safe must be properly chlorinated — and they won't tolerate dangerous undertreatment or the disagreeable taste resulting from overtreatment.

%Proportioneers% Automatic and Proportional High Pressure Chem-O-Feeder has long been the favorite of wise water works men . . . paced by standard water meter, it automatically injects just the right amount of treating chemical at just the right time. No external source of power is required: the Chem-O-Feeder is hydraulically driven by the water in the main itself. Even when pressures are as high as 200 lbs. per sq. in. and the flow varies from minute to minute, the Chem-O-Feeder provides precise, dependable water treating. Other %Proportioneers% units are available to meet every operating condition. Information on request.



%PROPORTIONEERS% *High Pressure Chem-O-Feeder starts, varies and stops dosage of chemical as water comes on, fluctuates and tapers off. Equipped with plastic "See-Thru" pump head and "fluid sealed yoke".*

% PROPORTIONEERS, INC. %

92 CODDING ST., PROVIDENCE 1, R. I.

Above is a small Sauerman "Crescent" Power Scraper stripping heavy overburden from a rock deposit. Note how the guide blocks are elevated to permit disposal of all the spoil in a single wide, high pile.

with SAUERMAN "CRESCENT" SCRAPERS

On thousands of dig-and-haul jobs, such as moving gravel from pits to screening plants, building earth dams, cleaning out reservoirs, strip mining, etc., Sauerman Crescent Scrapers daily are proving their ability to handle almost any class of materials for a few cents a yard.

The secret of "Crescent" efficiency is in the streamline design of this scraper. A Crescent bucket penetrates hard-packed materials with ease, gets a full load quickly, hauls this load at speed of 400-600 f.p.m.—all with a moderate expenditure of power. *Write for Catalog.*

SAUERMAN BROS., INC.

532 S. CLINTON ST. CHICAGO 7, ILL.

complete operation of stereograph showing how it produces perspectives to hair-line accuracy without vanishing points, grids, outriggings or other cumbersome accessories.—*Pomeroy Stereograph Co., Inc., 318 Ferguson Bldg., Cleveland 14, Ohio.*

Generators—(4-p. pamphlet) Describes latest models of generators and four-circuit automatic equipment for charging motive power batteries used in electric trucks and in locomotives used for underground hauling.—*Motor Generator Corp. Division of The Hobart Brothers Co., Hobart Square, Troy, Ohio.*

"Night-Cooling" of Industrial Buildings—Highlights of the story are given in a new 4p. folder, illustrating and describing ILG cooling equipment and methods.—*Ilg Electric Ventilating Co., 2850 North Crawford Ave., Chicago 41, Ill.*

Pipe Couplings—(106-p. catalog) Contains full description of every Dresser product. Novel feature, "Visual Index", illustrates 36 principal pipe joining and repair products, together with brief descriptions of their uses and page numbers on which details can be found.—*Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pa.*

Powder Metallurgy—(48-p. catalog) Gives information on both powdered metal parts and powdered metal bearings.—*Keystone Carbon Co., St. Marys, Pa.*

Air Filters—(23-p. booklet) Discusses various types of industrial dust problems and typical applications of air filters. Included are a chart of size and characteristics of air-borne solids and sections dealing with atmospheric dust and filtered air.—*American Air Filter Co., 215 Central Ave., Louisville 8, Ky.*

Learning to Weld—(32-p. booklet) Provides simple basic approach for anyone interested in making start in arc welding. Its purpose is to teach how to weld and to assist in applying arc welding to repair of broken parts, hard surfacing of worn parts and building of miscellaneous equipment. Subjects treated include protective clothing and equipment; striking the arc; various welding positions; types of welds; fit-up of parts; procedures for various welds including fillets in horizontal, flat, vertical and overhead positions, butt welds, lap welds, corner and edge welds; welding cast iron; hard surfacing. Priced at 25 cents per copy.—*The Lincoln Electric Co., Cleveland, Ohio.*

POWERED FOR THE PULL

CHEVROLET

PROTECT THOSE FINE CHEVROLET TRUCKS with . . .

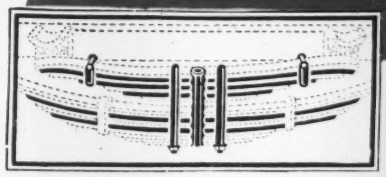
MOOG

ELECTRICALLY

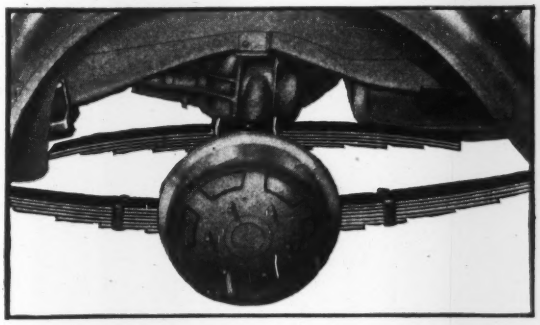
HEAT TREATED OVERLOAD HELPER SPRINGS

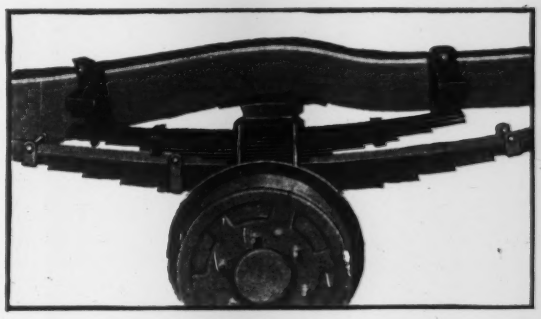
Many of the nation's fleets get extra protection for extra pay loads with Moog Helpers. Tailored to fit and engineered for Chevrolet overload jobs, these electrically heat treated springs are Moog quality through and through. There's a Moog distributor, branch or warehouse near you.

★



ST. LOUIS SPRING CO.
Division: MOOG INDUSTRIES, INC.
6650 Easton Ave., St. Louis 14, Mo.





FOR CHEVROLET ½ TON TRUCKS

YEAR	MODEL & DESCRIPTION	WIDTH	NO. LVS.	EXTRA CAPACITY	WT	MOOG SET NO.
1937-46	GC, HC, JC, KC, AK, BK, CK, DP - ½ ton	1¾	6		60	RH-80
1937-46	GC, HC, JC, KC, AK, BK, CK, DP - ½ ton (Ex.Hvy)	1¾	7		65	RH-81

FOR CHEVROLET 1937-46 1½ TON TRUCK
BOLT-ON TYPE BRACKETS

1937-46	HVY. STD.	2½	6	4000	95	RH-76
1937-46	HVY. DUTY	2½	7	5000	110	RH-77
1937-46	EXTRA HVY. DUTY	2½	8	6000	125	RH-78
1937-46	SPEC. HVY. DUTY	2½	9	7000	139	RH-79

FOR CHEVROLET 1946 2 TON TRUCK
SERIES OE, OF, PV & PW - BOLT-ON TYPE BRACKETS

1946	HVY. STD.	2½	6	4000	96	RH-106
1946	HVY. DUTY	2½	7	5000	111	RH-107
1946	EXTRA HVY. DUTY	2½	8	6000	126	RH-108
1946	SPEC. HVY. DUTY	2½	9	7000	139	RH-109

FOR CHEVROLET ¾ AND 1 TON TRUCKS

YEAR	MODEL & DESCRIPTION	WIDTH	NO. LVS.	EXTRA CAPACITY	WT	MOOG SET NO.
1946	DR – ¾ TON, 125¼" W. B.	2	6	1500	69	RH-104
1946	DR – ¾ TON, 125¼" W. B. (EXTRA HEAVY)	2	7	2000	77	RH-105
1946	DS – 1 TON, 134½" W. B.	2	6	1500	69	RH-110
1946	DS – 1 TON, 134½" W. B. (EXTRA HEAVY)	2	7	2000	76	RH-111
1941-42	AL, BL – ¾ TON, 125¼" W. B.	2	6	1500	68	RH-93
1941-42	AL, BL – ¾ TON, 125¼" W. B. (EX. HVY)	2	7	2000	76	RH-94
1941-42	AN, BN – 1 TON, SPL. 134½" W. B.	2	6	1500	68	RH-95
1941-42	AN, BN – 1 TON, SPL. 134½" W. B. (EX. HVY)	2	7	2000	75	RH-96
1941-42	AM, BM – ¾ TON, 125¼" W. B.	2	6	1500	68	RH-97
1941-42	AM, BM – ¾ TON, 125¼" W. B. (EX. HVY)	2	7	2000	75	RH-98
1937-40	¾ & 1 TON (EXCEPT 1940 KF)	2	6	1500	68	RH-90
1937-40	¾ & 1 TON (EXTRA HEAVY)	2	7	2000	75	RH-91

WARNING: When ordering 1941-1942 ¾ ton jobs be sure of model and wheel base.

★ *Moog built-up sets shown in Streamliner catalog . . . ask your jobber.*

SPECIFICATIONS

MODEL SERIES	1500	3100	3600	3800	4100	4400	4502 SCHOOL BUS	5100	5400	5700	6100-S 6100	6400-S 6400	6702 SCHOOL BUS
WHEELBASE	116"	115	125¼"	134½	134½"	160	160	109"	132½	158	134½"	160	195
GROSS VEHICLE WEIGHT (Maximum) (Maximum truck gross rating can be obtained only by adding Regular Production Options)	4100 lb	4600 lb	5800 lb	3804-5-7 6700 lb. others 8800 lb.	4104-5-7 11,000 lb. others 13,000 lb.	13,000 lb	12,000 lb	16,000 Pounds			6100S and 6400S—14,000 lb 6100 and 6400 —15,000 lb		15,000 lb
FRAME Type	Box-Girder	Channel											
Side Rail—Size	4¹⁵⁄₆₄ x 2¼ x ¹⁄₂"	5¼ x 2 x ⁵⁄₁₆	5¹⁵⁄₃₂ x 2¼ x ³⁄₁₆	7" x 2¼ x ⁵⁄₁₆"									7" x 2¹⁵⁄₃₂ x ¼"
Reinforcement Plates	None				Optional at Extra Cost	Yes—10" x ¼"							
AXLE, REAR (Hypoid Gear) Type	Semi-Floating			Full-Floating									
Capacity	3000 lb.	3300 lb.	5000 lb.	7200 lb.	10,500 Pounds			12,500 Pounds					
Ratio	4.11 to 1 (Optional 3.73 to 1)	4.11 to 1	4.57 to 1	5.14 to 1	5.43 to 1 (Optional, 6.17 to 1)			6.17 to 1 (Optional, at Extra Cost, 2-Speed—6.13 to 1 and 8.10 to 1)					6.17 to 1
AXLE, FRONT (I-Beam) Rating	2000 lb. KNEE-ACTION	2200 lb.	2500 lb.	3500 Pounds			4500 Pounds						
SPRINGS, REAR Size	49" x 1¾"	54" x 1¾"	46" x 2"	46" x 2½"									
Number of Leaves	8	8	7 Two-stage	12 (3803-8 & 9) 8 (others), 2-stage	10		11 Two-stage	10					11 Two-stage
Rate of Deflection per Inch	145 lb.	190 lb.	250 and 370 lb.	684 lb. (3803-8 and 9) 313 and 433 lb. (others)	770 Pounds		550 and 1000 lb.	770 Pounds					550 and 1000 lb.
Auxiliary Springs	None				Optional at Extra Cost		None	Yes, 6 Leaves, 31" x 2½", Rating—1530 Pounds					None
Combined Deflection Rate per Inch								2300 Pounds					
SPRINGS, FRONT Size	Unitized Knee-Action	36" x 1¾"		40" x 2"									
Number of Leaves		7	8 Two-Stage	7			9	8			9		
Average Deflection Rate per Inch	300 lb.	260 lb.	275 and 365 lb.	475 Pounds			640 lb.	575 Pounds			640 Pounds		
TIRES, REAR, Regular Single	6.00-16, 4-ply	6.00-16, 6-ply	15", 6-ply	3802-4-5-7-12-22 and 32 7.00-17, 6-ply	4102-12-22 and 32 7.00-20, 8-ply	4402-12-22 and 32							
Dual				3803-8 and 9 7.00-18, 8-ply	4103-4-5-7-8 and 9	4403-8-9-18-19 and 29 6.50-20, 6-ply		7.50-20, 8-ply					
Maximum Available—Single	6.00-16, 6-ply	15", 8-ply	7.00-17, 8-ply	3802-4-5-7-12-22 and 32 7.50-17, 8-ply	4102-12-22 & 32 7.00-20, 10-ply	4402-12-22 & 32							
Dual				3802-3-8-9-12-22 and 32 7.00-18, 8-ply	7.00-20, 10-ply	7.00-20, 10-ply		8.25-20, 12-ply			6100S 6400S 7.50-20, 10-ply* 6100 6400 8.25-20, 12-ply		8.25-20, 12-ply
TIRES, FRONT, Regular Single	6.00-16, 4-ply	6.00-16, 6-ply	15", 6-ply	3802-4-5-7-12-22 and 32 7.00-17, 6-ply	4102-12-22 and 32 7.00-20, 8-ply	4402-12-22 and 32		7.50-20, 8-ply					
				3803-8 and 9 7.00-18, 8-ply	4103-4-5-7-8 and 9	4403-8-9-18-19 and 29 6.50-20, 6-ply							
Maximum Size Available	6.00-16, 6-ply	15", 8-ply	7.00-17, 8-ply	3804-5 and 7 7.50-17, 8-ply All others 7.00-18, 8-ply	7.00-20, 10-ply	7.00-20, 10-ply		8.25-20, 12-ply			6100S 6400S 7.50-20, 10-ply 6100 6400 8.25-20, 12-ply		8.25-20, 12-ply
ENGINE	Thrift-Master; 216.5 Cubic Inches, 6 Cylinders, Valve-in-Head							Load-Master; 235.5 Cubic Inches, 6 Cylinders, Valve-in-Head					
Gross Torque, Maximum	174 Foot-Pounds, 1200 to 2000 R.P.M.							189 Ft.-Lb., 1000 to 1900 R.P.M.			192 Ft.-Lb., 1000 to 1900 R.P.M.		
Gross Horsepower, Maximum	90 at 3300 R.P.M.							90 at 3100 R.P.M.			93 at 3100 R.P.M.		
COOLING SYSTEM	Harrison Ribbed Cellular Core, 14-Quart; Self-Adjusting Centrifugal Pump							Harrison Ribbed Cellular Core, 16-Quart; Self-Adjusting Centrifugal Pump					
GOVERNOR	Optional at Extra Cost						35 M.P.H.	45 M.P.H					35 M.P.H.
OIL BATH AIR CLEANER	Optional at Extra Cost							4-Pound Dirt Capacity			2-Pound Dirt Capacity		
CLUTCH, Single Disc, Diaphragm Spring	9⅛" Diameter, 200 Ft.-Lb. Torque			10¾" Diameter, 200 Foot-Pounds Torque									
TRANSMISSION	3-Speed Synchro-Mesh 4-Speed Optional on 3100 and 3600			4-Speed, Sliding Gear; Provision for Power Take-off									
BRAKES, SERVICE Front	11" x 1¾"			12" x 2"	14" x 2"								
(Hydraulic) Rear	11" x 1¾"		12" x 2"	14" x 2½"	16" x 3"								
Total Lining Area, Sq. In.	161	159	178	243	330								
Booster, Single Piston	None			Optional at Extra Cost				Yes					
Parking	Cut in on Rear Wheels—All Models												
STEERING GEAR Ratio	17.5 to 1	19.8 to 1						23.6 to 1			19.8 to 1		
FUEL TANK Capacity, Gal	16	3103 and 4-18 All Others-16	18				20	18					20

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CHEVROLET TRUCKS—BUILT FOR THE LOAD—POWERED FOR THE PULL

Specifications

THE CLOSED SHOP

Key to Labor Monopoly

IF THE PEOPLE of the United States are to loosen the monopoly control now exercised by some segments of union labor and recapture the power to control their own economic and political destiny, they must come to grips with the problem of the closed shop. A satisfactory solution of that problem is as vital to the interests of the wage earner, who should be fully protected in his right to organize and bargain collectively through representatives of his own choosing, as it is vital to the interests of the nation as a whole.

By the closed shop, which unfortunately is a term that seems to shed more heat than light, I mean any shop in which the worker must make his peace with a union in order to have a job. There are approximately 13½ million union members in the United States. Of these about 10 million are governed by arrangements calling for "closed" shops, union shops, maintenance of membership provisions and similar devices which make good standing in a union a condition to holding a job.

Such arrangements raise serious issues about what is commonly presumed to be the basic American right to work. Also, closed shop arrangements lie at the root of the dominant economic power now exercised by some labor leaders.

The problem of reducing the power of these labor leaders to proportions that make it safe for democracy is the age-old problem of monopoly. In an earlier era this problem was created largely by businessmen who sought to escape the restraints of competition by combinations or agreements to control prices and production. Such efforts are still attempted and must be curbed by law.

Union Labor Monopoly

But, after more than a decade during which a monopoly position for organized labor has been aggressively promoted by the federal government, the major monopolists today are those labor leaders who wield the power of enormous nationwide unions. About 90% of the soft coal miners do the bidding of John L. Lewis. A like percentage of the auto workers are represented by the United Automobile Workers of the C. I. O. About 80% of the production workers in steel are members of the United Steel Workers, C. I. O. No single corporation has more than a fraction of the economic power that is concentrated in these unions. And if corporations were to combine their power to cope effectively with that of these union monopolies they would unquestionably find themselves charged with violating the federal antitrust laws.

In its national sweep, the monopoly power of unions rests largely on their exemption from the federal antitrust laws. My previous editorial in this series (the 53rd) discussed the desirability of removing that exemption. The local roots of this monopoly power are often embedded in closed shop arrangements.

Closed Shop in Coal

An illuminating case in point is provided by the United Mine Workers, whose leader John L. Lewis has graciously given the country a 3½-month reprieve from "the hysteria and frenzy of an economic crisis," as he himself termed it. During that latest crisis the dispatches from the soft coal fields reported that the miners were standing behind John L. Lewis almost to a man. And the implication usually was that the driving forces of the strike were loyalty to Lewis and the prospect of economic gain.

Underlying that performance, however, and basic to it was an agreement in the soft coal fields providing that "as a condition of employment all employees shall be members of the United Mine Workers." Hence to hold a job in 90% of the soft coal industry which is governed by contracts with the United Mine Workers, a miner must not offend the union. To avoid offense the union member must even be careful in criticising what his union

does. *Suspension from the union for six months, and hence from the right to hold a job,* is the penalty imposed by the United Mine Workers constitution for circulating a statement "wrongfully condemning any decision rendered by any officer of the organization."

The willingness of the miners to follow Lewis until the country froze over was not, of course, exclusively a product of the agreement limiting jobs in the coal fields to union members of good standing. Some of it originated in bad handling of employee relations in the coal fields in years gone by. But the fact remains that Lewis' soft coal monopoly has as one of its principal foundations an agreement which gives the United Mine Workers a job-or-no-job hold on 90% of the soft coal miners.

In its extreme form, the closed shop not only makes union membership a condition of employment but narrowly limits the numbers admitted to union membership and hence to the opportunity to work. In this way it is used to enforce restriction of output and working rules which would never stand up under free competition.

Fair Dealing

The closed shop raises major issues of personal freedom and fair dealing between individuals. As matters now stand, closed shop agreements require employers to discharge workers who lose their good standing in the unions involved. At the same time they frequently impose no requirement on unions to grant membership to law abiding and technically qualified persons. Many unions with closed shop agreements refuse to grant membership on the basis of competence. Thus, qualified workers are denied a fair chance to hold a job.

In its dealings with the closed shop issue the federal government has been pushed into a self-contradictory position. The National Labor Relations Act (the Wagner Act) provides, and properly, that "employees shall have the right . . . to bargain collectively through representatives of their own choosing." In furtherance of that basic proposition, the Wagner Act also provides that "It shall be an unfair labor practice for an employer . . . by discrimination in regard to hire or tenure of employment to encourage or discourage membership in any labor organization . . ." Standing alone, the provision would clearly outlaw the closed shop.

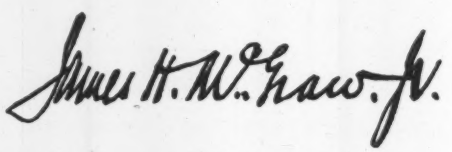
But then, to favor the closed shop, the Wagner Act turns right around and provides that "nothing in this Act . . . shall preclude an employer from making an agreement with a labor organization . . . to require, as a condition of employment, membership therein," provided that certain conditions of representation are fulfilled. This places the National Labor Relations Board in the impossible position of trying to administer a law which simultaneously points in opposite directions.

In successfully contending that there should be no closed shop arrangements on the railroads, the late Joseph Eastman, Federal Co-ordinator of Transportation, said, "If genuine freedom of choice is to be the basis of labor relations under the Railway Labor Act, as it should be, then the yellow dog contract and his corollary, the closed shop . . . have no place in the picture." The so-called yellow dog contract, which requires a worker to agree not to join a union as a condition of employment, has long since been outlawed.

At one time the closed shop was defended as a protective device for feeble young unions struggling against predatory employers. But a mere glance over the current economic scene discloses that the time when that argument was supported by the facts is past. Now it is the labor leaders who frequently exercise decisive economic power.

At elections in November three more states, Arizona, Nebraska and South Dakota, passed constitutional amendments outlawing the closed shop. In doing so, they joined six other states, which, in one way or another, have restricted the closed shop. The South Dakota amendment presented the basic issue created by the closed shop in simple and direct terms when it declared that "The right of persons to work shall not be denied or abridged on account of membership or non-membership in any labor union, or labor organization."

That issue must be squarely faced by the new Congress if its first order of business, the labor crisis, is to be resolved.



President McGraw-Hill Publishing Company, Inc.

THIS IS THE 54TH OF A SERIES

INDUSTRY-WIDE BARGAINING...

Death Trap for Business, Suicide for Free Labor

IF CONGRESS is to succeed in its present efforts to prevent strikes in key industries from devastating the nation, it will have to put a crimp in industry-wide collective bargaining. This kind of bargaining is designed to apply agreements between employers and organized workers on wages and working conditions to an entire industry.

Further, if extension of this type of bargaining is not curbed, there is reason to believe that it will undermine the freedom of both American business enterprise and American wage earners. For, while increasing the destructive power of labor disputes, the general spread of industry-wide bargaining would so concentrate the fixing of wages—by far the largest element in the cost of production—that government regulation would be a next short step. With that step taken, freedom for business enterprise and freedom for labor would be well on the way out.

Unfortunately, industry-wide bargaining is commonly regarded as presenting a general conflict between organized labor and employers, with unions favoring it and employers opposed to it. This mistaken notion raises the heat of much of the discussion without increasing the light. The fact is there is no such general conflict. Employers and organized workers are on both sides of the argument about industry-wide collective bargaining. For example, while some union leaders are characterizing as labor baiters all those who raise the slightest question as to the desirability of industry-wide bargaining, organized workers in the air transport industry are strenuously opposing that type of bargaining; and the employers are advocating it.

Some Employers Like It

The reason there is in fact no clear cut issue between employers and unions over industry-wide bargaining is readily understandable. It presents certain advantages to both sides in the bargaining process. For example, union advocates of such bargaining generally stress the fact that industry-wide agreement on wages protects wage standards from being undercut by lower wage areas and lower wage employers. By much the same token, however, employers who like it often emphasize the fact that industry-wide bargaining may save certain well-managed and prosperous companies from being singled out for particularly heavy wage exactions. This general point has been underlined in both the full-fashioned hosiery industry and the West Coast paper and pulp industry. There, local unions, affiliated with international unions, have protested that industry-wide collective bargaining prevents them from getting from especially prosperous employers wages as high as they could get if allowed to go it alone in collective bargaining.

So long as employers remain subject to the federal antitrust laws while unions are exempted, the balance of power in industry-wide bargaining would seem to be heavily weighted on the side of the unions. If, for example, employers were to announce an intention to match an industry-wide wage increase by an industry-wide price increase, there is no doubt that they would promptly be indicted for violation of the federal antitrust laws. Even so, the fact remains that some employers favor industry-wide bargaining while some segments of organized labor are against it.

A Clear Cut Public Issue

The industry-wide bargaining issue as it affects the public, however, is clear cut. It is concentration of economic power (in the hands of both unions and management) which can make industrial conflict devastating to the public welfare. At least five times within about a year—in steel, on the railroads, in the maritime industry and twice in the soft coal industry—strikes prompted by union efforts to impose industry-wide agreement about wages and working conditions have paralyzed large parts of the nation's economic life.

In soft coal about 90% of the production workers are members of the United Mine Workers. In steel

about 80% of the production workers are members of the United Steelworkers, C. I. O. In some other key industries there is a comparable degree of concentration of union control. In the face of such concentration many employers see no alternative but to get together on their side for industry-wide bargaining. But when they do so in key industries, the odds are lengthened that failure to agree on wages and related matters, will result in generally ruinous conflict. If agreement is reached, the chances are increased that it will take too little account of the welfare of the consuming public.

It is possible to have industry-wide bargaining on many subjects other than wages. *But the main interest is wages; and the main drive is toward industry-wide and ultimately nation-wide uniformity. Such uniformity is the deadly enemy of industrial decentralization and the pioneering expansion of industry in new areas.* Why pioneer, with inexperienced workers, if the wage rate must be uniform for the whole industry? Moreover, it would also be hard to conceive of a more effective way to put a blight on local efforts to improve industrial relations than to make wage rates and other working conditions uniform throughout the industry and then the nation. *However, among many other dangers, the overshadowing danger in industry-wide bargaining lies in its concentration of economic power.*

Wages Monopolized

On the average, the cost of labor accounts for about two-thirds of the total cost of all industrial products. The universal spread of industry-wide bargaining would thus concentrate in relatively few hands control of the greater part of the cost of industrial production. There is no reason to believe that even without disastrous strikes, such concentration would long continue free from government regulation. That would turn more earth for the graves of American business enterprise and American working men's freedom.

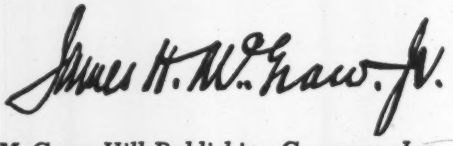
Those who believe that industry-wide bargaining serves the public well—and many sincere people do—stress the fact that, on the whole, it has worked in the industries where it has been tried over a considerable period. Most of the industries of which this is true, however, are not key industries. The pottery industry, the glassware industry, and the silk and rayon dyeing industry—to cite a few in which industry-wide bargaining has been practiced with considerable success—are important industries. But they are not industries in which strikes would have a ruinous impact on the nation. In contrast, a strike in the soft coal industry as the result of a breakdown of industry-wide negotiations quickly becomes a national disaster. The dangers inherent in industry-wide bargaining are multiplied accordingly.

England No Guide

Those who think extension of industry-wide bargaining would be good for the public often emphasize the fact that it has worked smoothly in England, where it has been extensively practiced. *Not the least of the things it has smoothed in England, however, is the transfer from private enterprise to state socialism of industries in which industry-wide bargaining by monopolistic unions and employer groups had so badly undercut competition that private enterprise had lost much of its justification.* A general extension of industry-wide bargaining could be expected to have the same consequences in this country.

The best way to curb industry-wide bargaining is a question which lies beyond this discussion. *Much would be accomplished if the federal government would discontinue its active promotion of industry-wide adjustments, in the fields of both labor and management, at which it has been busy ever since N. R. A. days. Still more would be accomplished if the federal antitrust laws were applied with even-handed justice both to unions and employers—a course urged in the 53rd editorial in this series.* Perhaps a definite limitation of the scope of labor agreements would also be necessary.

The effects of industry-wide bargaining in increasing the extent of public regulation of industry will vary. They will, of course, be less pronounced in railroads and other public utilities, which are already extensively regulated, than they will be elsewhere. For unregulated industries, however, industry-wide bargaining carries the threat of extensive regulation and, along the way, of industrial conflict devastating to the public. In these excited times, to say what I have said here is to invite characterization by overheated partizans as a foe of legitimate union progress. That is perhaps not so bad, however, as to qualify as a pall bearer for both American business enterprise and some of the basic freedoms of American working men. That may well be the fate of those who blindly accept the expansion of industry-wide collective bargaining as being "in tune with the times."



President McGraw-Hill Publishing Company, Inc.

THIS IS THE 55TH OF A SERIES

TAX REVISION...

Can Make or Break American Business

IS THE American way of life—progress by private initiative—going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U. S. A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple. It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting $6 billions out of President Truman's $37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below $25 billion for any year that is in sight.

Drastic Budget Cuts Required

Indeed, to get the tax load down to $25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize *every* item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms—especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eighty-six percent of the experts agree that an income-averaging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets—and particularly for management men—has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise—for example, the confiscatory rates which drive the people in the high brackets away from risk-taking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards—as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such tax exemption must be eliminated.) The list of obstacles could be amplified.

Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off $800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as $4 billion.

Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly—and as sensibly—as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.

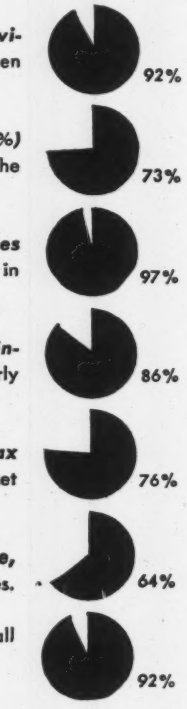
Through such a design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the necessary estimate.

Instead, federal tax revision continues to be a hit-and-run business—and a short-run political business. Take, for example, the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.

EXPERT OPINION ABOUT TAX REVISION

TAX EXPERTS THINK WE SHOULD:	% Of Tax Experts Favoring the Proposed Changes
1 ***Eliminate double taxation of corporation dividends*** which are now taxed as corporate profit and then again as individual income.	92%
2 ***Reduce corporation income tax rate (now 38%)*** as rapidly as budget needs permit until it equals the initial rate for individual incomes (now 20%).	73%
3 ***Provide for averaging business' taxable incomes*** over a period of about 6 years to allow for losses in bad years.	97%
4 ***Provide for averaging individuals' taxable incomes*** over a period of a few years so as to treat fairly those whose incomes fluctuate.	86%
5 ***Reduce upper bracket individual income tax rates*** to a maximum of 50% in the $100,000 bracket and 75% in the million and over bracket.	76%
6 ***Treat capital gains, now taxed at a lower rate,*** like other income but provide full allowances for losses.	64%
7 ***Remove the privilege of tax exemption*** from all future issues of state and local government bonds.	92%



James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 56TH OF A SERIES

OUR TEACHERS—

They Need The Help Of Business Now

THIS is an appeal to raise school teachers salaries—fast. Such appeals are commonly addressed, rather vaguely, to the conscience of the community. This one is not. It is addressed directly to the business community, and to its hard core of common sense.

As a whole, the school teachers of the nation are taking an economic beating. So, too, are their close associates and co-workers, the librarians. In purchasing power, public school teachers salaries, after taxes, average about 20 percent less than they did eight years ago. Beginning salaries of librarians, always low, have fallen behind an equal amount in purchasing power. College and university teachers are not much better off. The pressure is particularly heavy on those in the lower ranks. As a group, teachers and librarians are close to the bottom of the economic heap.

Unless this situation is remedied promptly, it is confidently to be expected that:

1. The more competent teachers will continue to desert our schools in droves, and our libraries will remain inadequately staffed. More than 350,000 teachers — many of them the very able ones—have left the public school teaching staff of about 900,000 in the last six years. More than 100,000 of the replacements are "substandard." They cannot meet the minimum educational requirements of their jobs which, by admission of the profession itself, are none too high.

2. Those who remain will be organized increasingly into economic pressure groups. Teachers strikes and the rapid growth of unionism among teachers at present clearly indicate what is in store.

Many business men are so deeply disturbed by the resort to the strike weapon by some teachers to enforce their salary demands that their sympathy for the general plight of our teachers tends to be dulled. Such an attitude is understandable. It avails nothing, however, in eliminating the crisis in education caused largely by teachers salary troubles.

The crisis in education is a crisis for the nation as a whole. The work of our schools, colleges and libraries is such that its deterioration means deterioration of the nation. However, the salary crisis in education is in special measure a crisis for the business community. That community has a special stake in having a well-educated and well-disposed constituency.

Education and Unionism

There may be room for disagreement as to whether teachers should organize themselves in trade unions, and follow trade union tactics. However, there is no conceivable room for disagreement as to whether organization of teachers into a fighting economic pressure group under the lash of a teachers salary crisis would be a body blow to business. Among many teachers it would foster an abiding hostility to the institution of business which, occupying a key position in the life of the community, had not done its utmost to make such unionization unnecessary by taking a lead in relieving the teachers salary crisis.

In our work of publishing technical periodicals and text books, we at McGraw-Hill meet and come to know many teachers and librarians. We know that, as a group, they have little appetite for participation in militant economic pressure groups. They are far more interested in making a militant assault on ignorance and prejudice through concentration on their professional work. If, through neglect of their economic needs by the business community, they feel forced to resort to trade union organization and tactics, the teachers and librarians can be expected to have an abiding re-

sentment toward the institution of business. That resentment will, in turn, be communicated in no small measure to the coming generation. Such is the nature of the educational process.

The crisis in education is not, of course, exclusively a matter of salaries. Unsatisfactory working conditions also play a part. Many schools are dilapidated and terribly overcrowded. So are some libraries. Some small-town school boards oppressively insist that the school teachers be the paragons of piety the board members wish they were themselves. Protection of a proper degree of academic freedom is sometimes missing. The teacher is rarely accorded a prestige comparable to the importance of the job. Elements such as these aggravate the crisis in education. But the first and absolutely essential step toward surmounting the crisis is to provide tolerable salaries.

Because of the enormous diversity of local conditions affecting teachers and librarians salaries, no general rule for emergency action would fit all cases. From state to state, average yearly expenditures on education in 1940 varied all the way from about $30 per pupil to about $150. Some states, like Nebraska, finance their schools almost exclusively from local taxes. Others, like Delaware, rely almost entirely on state taxes. Some states and communities have already acted to meet the salary crisis. Others have not. Variations such as these limit any generalization.

Guide for Emergency Action

But as a general proposition it can be safely said that the minimum requirements of the emergency will not have been met so long as the salaries of class room teachers and junior members of college faculties and library staffs have not been increased by the amount necessary to keep them abreast of the increase of about 50 percent in the cost of living since 1939. In many cases, a temporary cost of living adjustment might prove the best way to handle the problem.

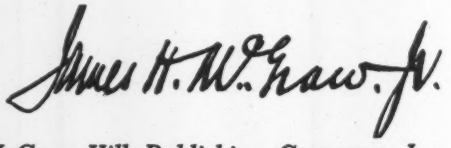
This suggestion, let it be repeated, is not offered as a solution of the salary problem, but as a start. With their salaries increased enough to meet the increased cost of living, the teaching and library groups as a whole would still have cause to envy the current economic position of industrial workers. Since 1939, the average of weekly earnings of industrial workers after taxes, has outstripped the rise in the cost of living by about 21 percent.

However, a start and an absolutely essential start would be made toward giving America the sort of educational system it must have not only to fulfill its ideals but holds its own in this highly competitive world. We worry, and I think rightly, about having the free world engulfed by Russian Communism. According to the best figures available, the U.S.S.R. is spending about twice as large a share of its total national income for education as we are. The figures compared include our expenditures for both public and private education. That comparison is really something to worry about.

States Should Take Lead

In dealing with the salary crisis it is up to the teachers to display a maturity and integrity worthy of their profession. Teachers have many employment advantages, such as long vacations. They should not slur them over in making comparisons of their annual incomes. Also employment in teaching and libraries has been notably stable. Teachers and librarians should not ignore that fact in comparing their position with those whose employment has been far less steady.

At the same time, the great fiscal difficulties involved in solving the crisis in teachers and librarians salaries must not be used as an excuse for postponing effective action. The states are better equipped financially and otherwise to take such action than is the federal government and, with the localities directly involved, should take the lead. If the price of effective action is a heavier tax burden for communities already too heavily burdened that price must be paid. The crisis presents a major emergency. To handle it as anything less is to court irreparable damage to the nation as a whole, and a special measure of damage to business as well. The intelligent self-interest of business requires that it leave nothing undone to meet and master the crisis in education.



President McGraw-Hill Publishing Company, Inc.

THIS IS THE 57TH OF A SERIES

WORLD LEADERSHIP...

Our Duty and Our Opportunity

CAPITALISM in Europe and the rest of the world is challenged by a real and formidable rival, communism. For capitalism to thrive a reasonable amount of prosperity is essential. Communism uses poverty to advance itself.

Except for the Western Hemisphere, most of the world came out of the war poor. Two years after V-E Day it is still poor. It needs dollars. It needs credit. It needs capital. It needs trade. It needs technical and managerial skills.

If we in America are to help the rest of the world back to its feet, starting it again on the road to peace and a free economy, we should try to supply those needs within the limits of our capacity.

We must not overtax our own strength. For the first requirement of a stable world is a strong United States. But we must accept leadership in international economic recovery—in our own self-interest.

What can the United States do to help men back to prosperity in a world economy which will allow them *freedom and incentive?* There are many things. But here are two of the most important:

1. The United States, through Congress, must determine the pattern and the total of the foreign loans or grants it can afford. We must answer three questions. How much will the new program cost? Can we afford it? Have we the technicians and managers to watch the loans, assuring their fruitful use?
2. We must demonstrate that we do not intend to raise our tariff walls to prohibitive heights when our debtors begin to repay us in goods and services, which is the only practical way they can pay us. Otherwise our loans will become losses.

If the United States is to meet even the minimum requirements of world rehabilitation, Congress eventually must authorize more advances than those to Greece and Turkey. The $400 million for those two countries will not do the over-all job of political and economic defense which we have begun. A minimum of $5 billion, if promptly and wisely applied in eight to ten countries, might suffice. BUT this $5 billion will be on top of approximately $16.8 billion which we have spent or earmarked during the past two years for use abroad, including our full share of the World Bank and Fund. We shall do a faster and more effective job if Congress will thus add up the foreseeable total of our international aid, and, even though the total looks imposingly large, commit us to it, with proper collateral safeguards from the debtor nations.

Congress need not try to foretell all contingencies, like last winter's weather in Britain, and it certainly should not create the impression that nations need only ask for billions to receive them. On the other hand, the war should have taught us the miserable consequences of "too little and too late." The President should have learned that he engenders skepticism by going to Congress with parts of a program, as he has done in the British, Grecian and Turkish loans. Within the limits of our capacity, we must make the decision now to see the whole job through—or throw in the sponge.

In the interest of the debtor nations—as well as in our own interest—the loan program should be hard-boiled. Rehabilitation loans must really rehabilitate. They must produce a state of economic health which will permit the World Bank and private capital to take over the task of financing world recovery—as perhaps can be done today in France and the Low Countries.

The loans, therefore, must be within the limits of our technical and managerial ability to implement them. Without technical help, Greece can not use its loan effectively—to rebuild railroads, clear ports, revive agriculture. Without skilled supervisors, Germany can not be made to pay its way. Money alone won't pull China from the brink of economic chaos.

Our lending calls for more than money. It calls for trained personnel to help the recipients utilize the loans effectively—geologists, construction and sanitary engineers, monetary experts, and management and agricultural specialists.

Loans are necessary but they are only a first step. A long-range program requires the opening of the half-closed doors of world trade—our own door, too.

We will have to get used to the idea that, when our debtors pay us, they must pay us largely in goods and services. Refusal to permit such repayments in the twenties helped start the world depression in the thirties—and the loss of our investments. *Imports do tend to raise living standards, and a two-way trade program need not require us to slash our present tariff rates.*

The complexion of our foreign trade has changed since the war. Our manufacturing capacity has increased and our raw-material self-sufficiency is tending to decline. For example, we probably shall have to continue importing copper and zinc and to increase our prewar dependence on imported lead. We may soon have to depend heavily on imported oil, and—gradually—on a growing volume of iron ore from abroad. Our normal dependence on imports for commodities like rubber, tin and silk will continue.

Our population has gone up 10 million in the last decade, and we now have a $176 billion national income, making room for more imports.

As a result of every nation's recent attempts to make itself secure and self-sufficient by slamming its trade door, a world-wide series of quotas and restrictions is blocking international trade. Even more, government buying and selling threaten to take commerce out of the hands of private traders, placing it in the uninspired care of bureaucratic negotiators.

Our government has taken the lead in calling the conference of 18 nations, now meeting at Geneva, to open as many trade doors as possible. The American delegates will bargain product by product and country by country—all summer, if necessary—for lower tariffs, fewer quotas and a free flow of *private* trade. The task is a long one, and the results are as yet uncertain, but, if success is achieved, an immense opportunity for good works and good earnings will lie before American businessmen.

This is no picayunish opportunity. Authoritative estimates put our 1947 exports at $11 billion and our imports at $6 billion. That's substantial. It is greater than the value of all crops grown on our farms ($10½ billion) and exceeds the value of all shipments of industries such as automobiles ($9 billion), textiles ($8 billion) and chemicals ($8 billion).

International trade is vital, not to be shrugged off, not to be kicked around as a football of party politics. Republicans and Democrats agree on a non-partisan foreign *political* policy. They should agree also on a non-partisan foreign *economic* policy. The foreign relations of the United States, political or economic, can no longer be log-rolled hither and yon.

A general program for international recovery, outlined here, will bring its full quota of aches and pains. But lack of a program will produce economic and political troubles on a vast scale; timid retreat will invite economic disaster and war.

By an intelligent, bold and resourceful program, we have a chance to win through to a long peace in the kind of world we want. *Unless America provides the leadership, there can be no such program.* Then Communism merely needs to hang around long enough to pick up the pieces.

Ours is the responsibility and the opportunity.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

A NEW ENTERPRISE

Advocacy by the McGraw-Hill Publishing Company, in the accompanying editorial, of an effective world economic policy is not a mere verbal exercise. In the faith that we as a nation shall develop such a policy, this Company, following a trail blazed by leaders in American industry and finance, is expanding its operations overseas.

A newly created McGraw-Hill International Corporation will push forward the frontiers of our technical magazine and book publishing business throughout the world. The new Corporation comprises:

Eight international magazines—the McGRAW-HILL DIGEST, THE AMERICAN AUTOMOBILE and EL AUTOMOVIL AMERICANO, PHARMACY INTERNATIONAL and EL FARMACEUTICO, INGENIERIA INTERNACIONAL CONSTRUCCION, INGENIERIA INTERNACIONAL INDUSTRIA, THE MACHINIST.

A newsgathering agency, McGRAW-HILL WORLD NEWS, specializing in industrial and engineering coverage with correspondents in 36 world centers.

McGraw-Hill Publishing Company, Ltd. (London), serving the special needs of Britain and western Europe and publishing THE MACHINIST (London).

Five buyers' guides—AUTOMOTIVE EQUIPMENT (in English and Spanish), CONSTRUCTION EQUIPMENT, INDUSTRIAL MACHINERY and PHARMACEUTICALS (all in Spanish).

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says Combs Construction Company, Chattanooga, *about* MICHIGAN

This MICHIGAN owner, in a letter to Nixon Machinery & Supply Co., Chattanooga, goes on to say

". . . we have never gone wrong buying equipment that you recommend. Your claims were, if anything, conservative.

"We have used our MICHIGAN as shovel, back hoe, clam, dragline and in steel erection as a crane. In all operations it has proven a very efficient and economical machine. Operating and maintenance costs have been extremely low. Its mobility and flexibility, plus its other features has convinced us that it is an essential part of our equipment fleet.

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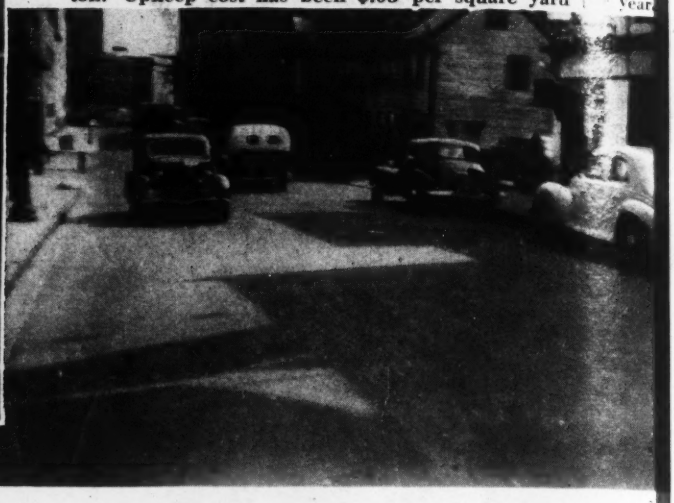
Maintenance: $.02 to $.03 per square yard per year

-year-old Texaco Asphalt pavement on Broad Street, Tren-
n. Upkeep cost has been $.023 per square yard per year.



21-year-old Texaco Asphalt pavement on Willow Str Tren-
ton. Upkeep cost has been $.03 per square yard year.

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Texaco Sheet Asphalt on Hamilton Avenue. Laid in 1946 by the Union Paving Company, Philadelphia.

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